

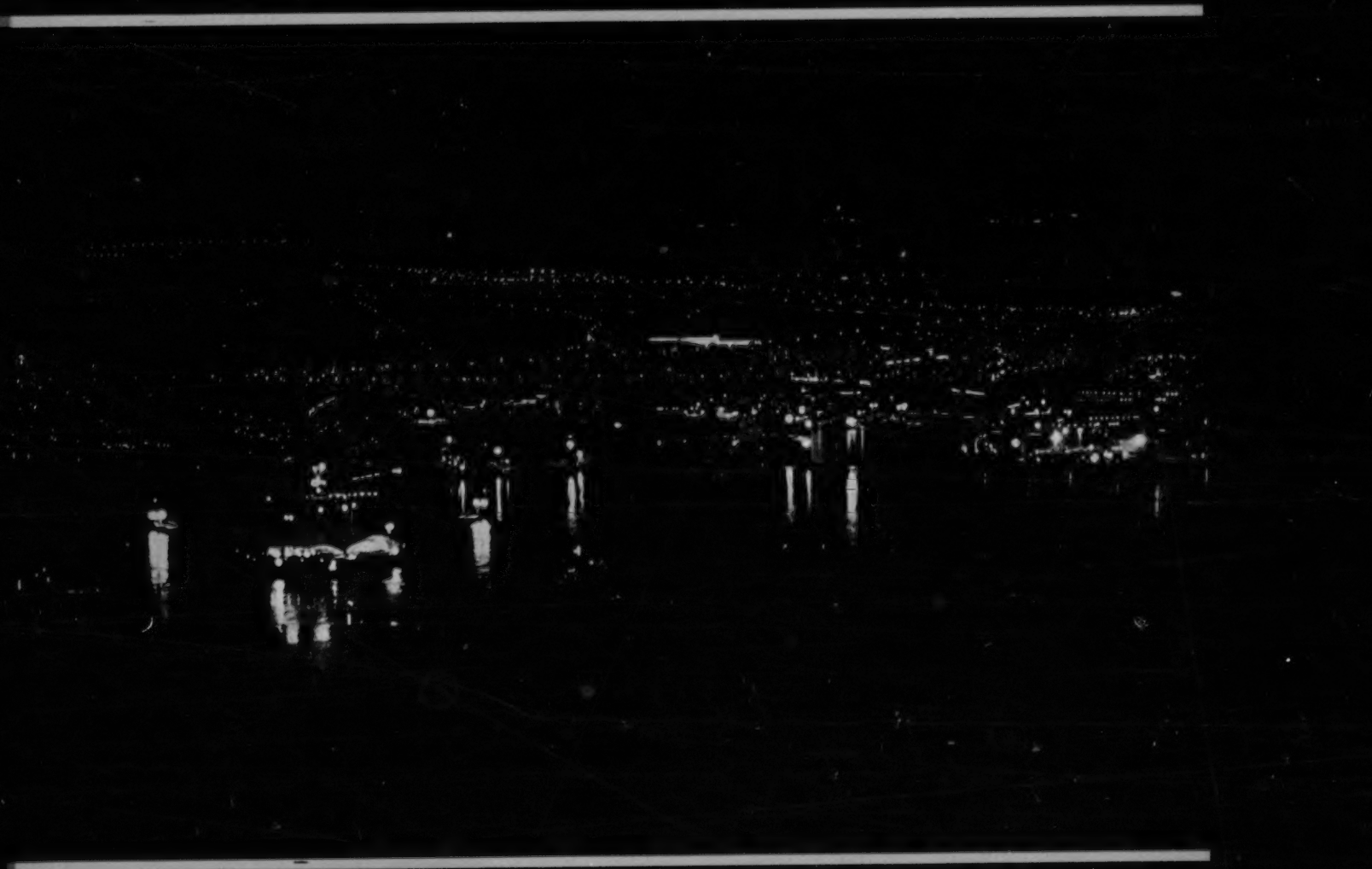
INTERNATIONAL
PETROLEUM
ENCYCLOPEDIA

1992

AMSTERDAM 1992

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International Petroleum Encyclopedia



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Next 25 years of petroleum
industry likely to mirror
turbulence of past 25

5 CHINA

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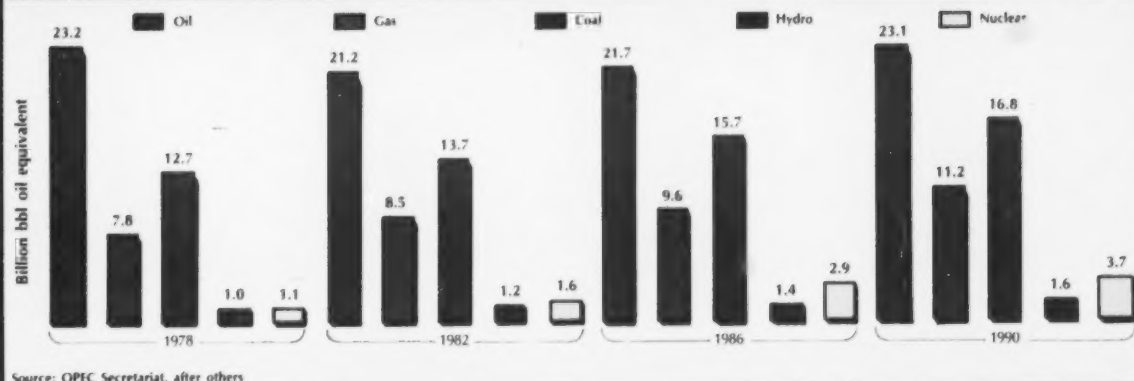
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carbon resources may be. With the stampede of foreign companies over the sprawling carcass of the U.S.S.R., it may be only a few years before oil markets know just how critical a factor that region's oil and gas will be to world markets.

What of the push by developing nations, especially in Latin America and to a lesser extent Africa, to bolster foreign investment in their petroleum sectors as privatization spreads across those regions? What if the free trade push, flourishing in North America, continues to spread south?

What of burgeoning economies of the Far East? Countries such as Thailand and Indonesia project annual energy demand growth rates in double digits. What happens if (when?) Viet Nam, Laos, North Korea, and Cambodia join them?

In the 1970 IPE was this echo of today's headlines:

"The Seventies will be a decade of dissent. The unrest and the dissatisfaction with standards of living have already been fed by man's geometric progression in communications. In the developing nations and in the most sophisticated of the industrialized countries, people are exposed to the evidence of the better life enjoyed by others. They are bent on getting more of it, and if governments withhold or deny their aspirations, governments will in time change their policies, or they will fall."

The environmental question

If there is one virtually foolproof prediction for the petroleum industry in the coming 25 years it is this: the

Iraq nationalizes most assets of Iraq Petroleum Co. group of western companies, puts Rumaila field on stream with Soviet help
Iran completes expansion of Kharg Island terminal

Indonesia's government approves plans for giant refining/petrochemical complex on Batam Island

Brunei delivers its first cargo of LNG to Japan

Removal of trade barriers spark flurry of tentative joint venture deals by U.S. companies in the U.S.S.R.

Cold snap causes oil and gas shortages across much of the U.S.

Central America has its first commercial discovery, Tortugas in Guatemala

Norway's Statoil, Denmark's DONG founded

1973

API calls on Washington to shape a national energy policy, warning of growing overreliance on foreign oil imports

Spain's first offshore field, Amposta Marino, starts up

Mexico becomes a net oil importer, and the government ends a 15 year freeze on domestic refined product prices

U.S.S.R. starts up supergiant Fedorovskoye oil field in Siberia

Ecuador and Gabon join OPEC

Japan negotiates major LNG import deals with Abu Dhabi and Indonesia

Iran completes nationalization of IOP western combine

OPEC takes over posting of crude oil market prices from multinationals

EPA unveils lead phasedown rule

World oil tanker tonnage on order hits a record 200 million dwt

Plans announced for three major oil sands projects in Alberta

Israeli forces damage Syrian oil facilities in October Arab-Israeli war

Arab oil embargo led by Kuwait and Saudi Arabia put in place

OPEC doubles posted crude marker price to \$5.12/bbl and 2 months later increases it to \$11.65/bbl

President Nixon signs Trans-Alaska Pipeline Authorization Act

Prime Minister Trudeau implements new controls and taxes on Canadian oil exports

President Nixon sets a U.S. policy goal of energy self-sufficiency by 1980

1974

U.S. Interior Dept. gets record \$210 million bid for oil shale lease in Colorado

Canadian companies drill string of discoveries on Mackenzie Delta

ENI drills Malossa gas/condensate strike, Italy's biggest, in Po Valley

Federal Power Commission orders single U.S. uniform ceiling price of 42¢/Mcft for interstate sales at the wellhead

First hydrocarbons discovered in West German sector of the North Sea

Japan's MITI approves plans for 16 refineries to expand capacity by 1.6 million b/d to 6.44 million b/d

Malaysia's government creates state oil company Petronas

India's ONGC discovers Bombay High giant oil field

Shell drills first hydrocarbon discovery off South Viet Nam

Ethiopian E&D halts with military overthrow of Emperor Haile Selassie

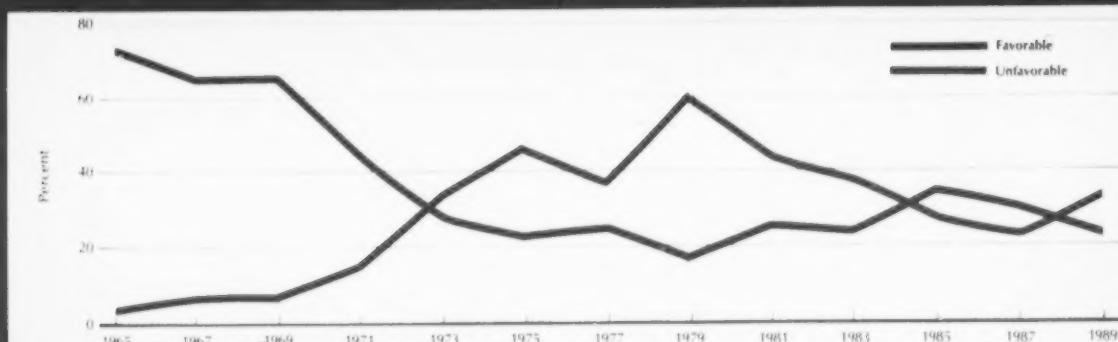
Libya completes majority ownership nationalization of foreign assets

Nigeria overtakes Libya as No. 1 African producer

Brazil drills first offshore Campos basin discovery, Garoupa

Colombia halts oil exports

Mexico regains oil self-sufficiency with start-up of Chiapas-Tabasco finds



*Favorability rating of oil and gas industry based on telephone interviews with a random sample of 1,000-7,000 adults/year.
Source: Opinion Research Corp. From: U.S. Petroleum Strategies in the Decade of the Environment by Bob Williams, PennWell Books, 1991

influence of environmentalism will continue to a major, if not the most important concern facing the petroleum industry.

Given the current momentum of environmentalism, the petroleum industry's very survival depends on how well it balances ecological concerns with economic concerns and then conveys a need for that balance to the public. Even \$5/bbl oil won't fuel economic growth if its use is severely restricted by direct or indirect prohibitions.

It was oil industry mishaps that gave birth to the modern environmental movement as a political and social force to be reckoned with in 1969 with the Santa Barbara Channel blowout and oil spill, and resurrected that force in 1989 with the Exxon Valdez tanker oil spill.

The oil industry's image took a beating after the 1969

spill, and helped by the price spikes of the 1970s and the 1989 spill, has yet to recover (Fig. 3).

The upshot of that deterioration has been exponential growth in the regulatory oversight of the industry on environmental issues (Fig. 4). The added costs have been staggering and yet are but a fraction of the costs to be paid the next 25 years. It will cost more than \$32 billion just to reformulate 80% of the U.S. gasoline pool to the specifications of the 1990 Clean Air Act amendments, according to Ashland Oil Co. Chief Economist Cyrus Tahmassebi. And yet a recent study by the National Research Council suggests that use of reformulated gasoline and alternate fuels may provide little benefit to urban air quality. NRC contends U.S. regulatory programs to control smog the past 20 years may have been misguided.

U.S.S.R. logs 596,000 b/d oil production increase, biggest annual increase
Canada's government announces plan to phase out crude oil exports to U.S.
Average price of U.S. crude, two-thirds under price controls, is \$7.05/bbl compared with landed price of \$12.66/bbl for Saudi marker
IEA administered international energy sharing program created

1975

President Ford unveils U.S. energy plan that includes "windfall profits" tax on crude oil
Zaire's first oil fields go on stream
Venezuela's government outlines plans for nationalizing oil industry
Alaska begins laying TAPS line
Frigg gas field development delayed with sinking of platform jacket
Ekofisk pipeline to U.K. starts up
First U.K. North Sea oil fields, Argyll and Forties, go on stream
Iraq completes reversible Kirkuk-Rumaila pipelines
Kuwait completes nationalization of foreign interests
Israel returns Sinai oil fields captured from Egypt in 1967 war
President Ford signs Energy Policy and Conservation Act, imposing another 40 months of oil price controls and creating 1 billion bbl strategic petroleum reserve, and Tax Reduction Act, wiping out almost all percentage depletion allowances and tightening foreign tax credits
Brazil's government authorizes Petrobras to seek risk service contracts with foreign companies
Scrapping reaches record 7.7 million dwt in depressed tanker market

1976

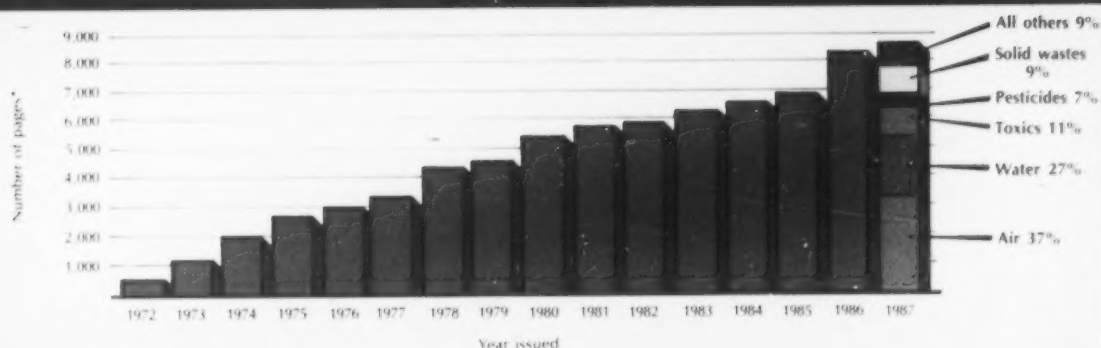
Saudi government, Aramco companies reach agreement on takeover of opera-

tions

Civil war suspends Angola-Cabinda oil production
Canada's state oil company, Petro-Canada, starts operations; Ottawa abandons oil energy self-sufficiency goal
Central America's first commercial oil production, Guatemala's Rubelsanto, goes on stream
Venezuela nationalizes oil industry
U.S. Federal Energy Administration unveils strategic petroleum reserve plan
U.S. oil imports top 1973 level in absolute terms and in percentage of total demand; Saudi Arabia becomes No. 1 source of U.S. oil imports
Harsh winter causes widespread curtailments of gas supplies by interstate gas pipelines
Interior holds lease sales of acreage off U.S. East Coast and in Gulf of Alaska
Brent field starts up in U.K. North Sea
Iraq shuts down Kirkuk-Mediterranean pipeline and shifts all crude exports to Persian Gulf tanker terminals
Qatar completes nationalization of foreign oil interests
Hondo A platform, at 945 ft the world's tallest offshore structure, is installed off California
Key discoveries revive interest in Williston basin and Overthrust belt
Elf Aquitaine, Japan National Oil Corp. predecessor founded

1977

OPEC adopts two tier pricing system for the first time
Nigerian National Petroleum Corp. established
TAPS line, history's costliest privately financed industrial project, completed; first Prudhoe Bay crude delivered to market



*Title 40 of the Code of Federal Regulations.

Source: Hart Environmental Management Corp. From U.S. Petroleum Strategies in the Decade of the Environment by Bob Williams, PennWell Books, 1991

With the environmental lobby continuing to home in on oil as Public Enemy No. 1, the petroleum industry faces a critical test to abandon its historically reactive stance and seize the initiative on environmental issues, educating politicians and public alike of the economic costs of bad science acting in the name of environmentalism.

Government's role

Worldwide, prospects for government playing a positive role in energy markets are perhaps the best they've been in decades.

A wave of privatization is sweeping across the petroleum sectors of many countries as the lessons of the the 1970s price shocks finally take hold. In country after country, especially in the developing world, barriers to foreign invest-

ment in domestic petroleum sectors are falling. Oil and gas law reforms are under way on each continent. Even some OPEC members, recognizing the enormous capital needs required to sustain or build productive capacity, are opening their doors to upstream equity investment by multinational oil companies. There will be an increasingly fierce competition for that private sector capital as reformist governments kick out the sagging props from under state run oil and gas enterprises and phase out unrealistic subsidies for petroleum products. The glaring exception to this trend is, of course, the U.S., where the political climate has made petroleum sector investment a highly risky venture.

Although there has been progress on oil and gas price decontrol and deregulation in the natural gas industry, widespread legislated hostility at federal and local levels

President Carter unveils U.S. national energy plan, focusing on conservation and oil and gas price controls

U.S. Department of Energy created, headed by first Sec. of Energy, James Schlesinger

Interior lease sale schedule includes program's first major postponements

FERC issues certificate for construction of Alaska-Canada natural gas pipeline system

First oil field goes on stream in Cameroon, offshore Kofe field

Mexico confirms major new trend in Gulf of Campeche

North Sea production tops 1 million b/d; 1,000th well drilled off U.K.

Ekofisk-Erden gas line, world's longest subsea trunk line, starts up

Delivery of first oil into U.S. SPR

Ekofisk blowout, first major North Sea oil spill, delays Norway's fourth concession round

Cognac, world's heaviest and deepest water platform, installed in Gulf of Mexico

Pemex announces plans to lay 48 in., 750 mile gas pipeline from Reforma area to U.S.

1978

Peru regains oil self-sufficiency

Canada reverses itself on phasedown of light crude exports to U.S.

GOSO, Canada's first commercial oil sands plant, starts up

Congress passes President Carter's National Energy Plan, Natural Gas Policy Act, and Fuel Use Act

BLM, Forest Service begin U.S. wilderness review programs

Texaco Baltimore Canyon gas strike is first hydrocarbon discovery off U.S. East Coast

Amoco Cadiz tanker oil spill off France is history's biggest at 1.8 million bbl

Marathon brings Kinsale gas field, Ireland's first commercial discovery, on stream

Saltpond, Ghana's first commercial oil field, starts production

Chile installs its first offshore platform in Strait of Magellan

Colombia replaces oil concessions with association contracts

Pemex discovers Chicotepec oil field, claims 100 billion bbl potential reserves

U.K. hikes tax take on oil production

Scotland's St. Fergus terminal starts up

Revolution in Iran halts oil exports to U.S. for 68 days, causing oil shortages

New Zealand's Petrocorp founded

1979

Chevron drills Hibernia discovery off Newfoundland

Mobil drills Mary Ann discovery to touch off Mobile Bay play

Iranian production resumes

President Carter revises NEP, including phased decontrol of oil prices and proposed "windfall profits" tax

Norway awards first licenses north of 62nd Parallel

U.K. government begins to reduce BNOC's role in offshore development

Australia's Northwest Shelf LNG export project approved

First commercial oil production in Philippines starts up

Pemex 1 Itzac well blowout in Gulf of Campeche initially flows 30,000 b/d

Crude transshipment terminal completed in Panama

Shah's trial, U.S.-Iran hostage crisis causes second cutoff of Iranian oil supplies, long service station lines in U.S.

Israel turns over captured Alma oil field to Egypt

cost the nation 300,000 jobs and add billions of dollars to its trade deficit. He said the bill, similar to the NES the administration proposed in January 1991, "has conservation, it has efficiency, it has R&D, and yes, it contains production."

The American Petroleum Institute called the vote "a tragedy because it is a serious setback to the future energy security and economic well being of every American. We continue to see exploration and development of the ANWR Coastal Plain as the key to increased domestic oil production. It is a project that could provide billions of barrels of oil, reduce growing dependence on insecure imports, and increase investments in our economy."

Meantime, the House energy and power subcommittee completed work on its omnibus bill but it contained neither ANWR nor CAFE provisions. The measure was expected to go before the full energy and commerce committee early in 1992.

Rep. Phil Sharp, D-Ind., subcommittee chairman, said the House bill would have a greater effect by far than opening ANWR and anything done on CAFE. He explained the House legislation went further in requiring energy efficiency standards for electrical appliances and set national energy efficient building codes for consideration by the states. The subcommittee staff said the House energy package would reduce U.S. energy use the equivalent of 2 million b/d by 2000 and another 3.3 million b/d by 2010. Table 1.

Oil and gas reserves

The Energy Information Administration reported that U.S. natural gas reserves increased in 1990 for the first time since 1981. Reserves inched up 1.3% to 169,346 tcf, Table 2, largely because of coalbed methane development sparked by federal tax credits. Gas reserves in Alaska and the Lower 48 not only increased, but the latter were higher than they were in 1985. Gas discoveries increased 23.3% and totaled 12,368 tcf in 1990. Major finds were drilled in New Mexico, in Alabama state water, and off Louisiana.

Crude oil reserves dropped less than 1% to 26,254 billion bbl, close to the average decline of 1.2% year for the previous decade. Crude oil discoveries were 20% less than the annual average for the previous decade.

Natural gas liquids reserves dropped 2.4% to 7,586 billion bbl in 1990.

EIA said natural gas reserves increased in Alaska because revised estimates of future gas requirements on the North Slope caused some technically recoverable Alaskan gas to be reclassified as economically recoverable proved reserves.

Reserves in coalbed methane fields increased 1,411 tcf in 1990, while production doubled. Increases in coalbed methane reserves in New Mexico, Alabama, and Colorado accounted for three fourths of the net growth in Lower 48 proved reserves of dry gas during 1990. Development of coalbed methane resources rapidly expanded because of tax incentives and an improved understanding of the production technology.

The tax credit amounted to more than 860 MMBTU of coalbed methane produced in 1990, which was more than half the average U.S. wellhead price of \$1.67 MMBTU during the year, EIA said. Coalbed methane proved reserves were 5,087 tcf at yearend 1990, while the revised estimate for 1989 was 3,676 tcf.

New field discoveries of dry gas amounted to 2 tcf, substantially higher than in 1989 and higher than the prior 10 year average of 1,934 tcf/year. Field extensions increased 25% to 7.95 tcf, and gas reserve additions from new reservoirs were up 7.5% at 24.12 tcf. Production of dry gas inched up 1.5% to 17.2 tcf for the year.

EIA said in recent years the net of revisions and adjustments played a larger role in sustaining Lower 48 gas

Table 1
Estimated effects of the House bill

	Oil imports avoided (b/d)	Total energy conserved (bbl of oil equivalent)
2000		
Efficiency provisions	49,000	851,000
Natural gas	331,000	—
Alternative fuels	780,000	—
Renewable energy	27,000	—
Coal	—	—
Coal seam gas	31,000	—
Strategic Petroleum Reserve	43,000	43,000
Total	1,261,000	894,000
2010		
Efficiency provisions	130,000	2,032,000
Natural gas	283,000	—
Alternative fuels	2,790,000	—
Renewable energy	39,000	—
Coal	—	—
Coal seam gas	31,000	—
Strategic Petroleum Reserve	—	—
Total	3,273,000	2,032,000

Source: House energy and power subcommittee

reserves. In 1990, about 6.4 tcf of those revisions were added, or about twice the annual average for the previous 10 years. Larger than usual revisions were caused by more effective development drilling and increased well completions.

EIA said the 0.09%, or 247 million bbl, drop in crude oil reserves in 1990 was close to the average decline of 1.2% year the previous decade. Most of the U.S. decline was caused by a 150 million bbl or 2.2% decline in Alaskan reserves. Lower 48 reserves of crude oil declined by only 0.5% to 19.73 billion bbl.

A number of areas had increases in reserves, including Texas with 140 million bbl and the Gulf of Mexico Outer Continental Shelf with 83 million bbl.

EIA said two thirds of the revisions and adjustments to reserves occurred in fields in four areas: Alaskan North Slope from enhanced oil recovery projects and installation of major gas handling facilities, West Texas from enhanced recovery projects, California due to expansion of heavy oil projects, and Gulf of Mexico OCS due to improved field performance.

Crude oil discoveries amounted to 689 million bbl in 1990, down 3% from 1989 and 20% less than the 861 million bbl/year average for the previous decade. Texas, Gulf of Mexico OCS, and Alaska dominated the crude discoveries with more than three fourths of the total.

Table 2
U.S. reserves at a glance

CRUDE OIL (billion bbl)	
Yearend 1989	26,501
Yearend 1990	26,254
Decrease	0.247
NATURAL GAS (tcf)	
Yearend 1989	167,116
Yearend 1990	169,346
Increase	2,230
NATURAL GAS LIQUIDS (billion bbl)	
Yearend 1989	7,769
Yearend 1990	7,586
Decrease	0.183

Source: Energy Information Administration

Table 3

U.S. gas resources and reserves

	1990	1988
	trf	
Gas field resources*		
Probable, current fields	1190.1	173.2
Possible, new fields	267.8	267.1
Speculative, frontier	262.9	265.2
Subtotal	720.8	705.5
Coalbed methane resources*		
Probables	9.6	—
Possibles	51.2	—
Speculatives	84.4	—
Subtotal	145.1	80.1
Proved reserves†	1167.1	187.2
Total	1,033.0	982.8

*Most likely values. †Includes 24.6 tcf previously carried as proved reserves in Alaska. §Not determined separately in 1988 report. ‡Department of Energy estimate; reflects removal of 24.6 tcf of Alaskan gas previously carried as proved reserves.

Source: Potential Gas Committee.

production costs

Supply/demand outlook to 2000

U.S. crude oil production is in the midst of a long slide that will dip to less than 6 million b/d by the end of the century, the Independent Petroleum Association of America's supply-demand committee forecast near midyear 1991.

The committee said U.S. production will amount to 5.7 million b/d in 2000, off about 1.6 million b/d from 1990 and 3.3 million b/d from the 1980s peak achieved in 1985 (Fig. 1).

U.S. crude oil flow hit its all time high in 1970 at 9,637 million b/d. Production has fluctuated a bit since then, but the trend has been down at an average rate of 1.4%/year, or 115,000 b/d/year.

Meantime, the IPAA committee said in its first long range outlook U.S. total petroleum imports will rise to 11.1 million b/d in 2000, up about 3 million b/d from 1991. By 2000, total imports will meet 60% of domestic petroleum demand, compared with less than 50% in 1991.

The committee said U.S. oil demand will rise at an average rate of less than 1% a year during the 1990s. Competition among fuels and continued efficiency gains will keep a lid on the growth rate. U.S. oil demand showed little growth during the 1980s, largely because of conservation in response to oil price increases and compliance with the federal government's CAFE standards for vehicles.

Utilization rate for U.S. refineries will be slightly higher than in 1990, the committee predicted. Department of Energy figures pegged the 1990 average monthly utilization rate at 87.27%, flat with 1989's 86.28%. High point for 1990 occurred in July, when utilization climbed to 92.6%. Average monthly utilization did not top 90% in 1989, DOE data show.

The IPAA committee forecast continued growth in U.S. natural gas use during the 1990s, rising to 22 tcf/year by 2000. Most of the growth will occur in the electrical power and industrial markets. Construction in the utility sector will favor gas because of things like requirements of the Clean Air Act (CAA). And natural gas will be the fuel of choice for projects in which short lead times are critical.

The US will see an average rise of 1.1% year in its natural gas flow, which will reach 19.1 tcf/year by 2000. Coalbed methane and other sources based on improved technology



will contribute an increasing share of production. Imports will climb to 3 tcf/year by the end of the century.

The rate of growth in U.S. total energy demand will slow in the 1990s, the committee said. The energy-gross national product ratio will continue to reflect gains in efficiency and reduced energy intensity. Energy demand will grow at only half the rate of economic growth during the decade.

In recent years, oil and natural gas lost market share to coal and nuclear power. But that trend will turn around during the 1990s. That's because construction programs for large nuclear and coal fired power plants are winding down, and use of existing coal fired plants and construction of new ones will be reined by the CAA. In addition, hydroelectric potential is limited by lack of development opportunities.

Oil imports predicted to rise

The U.S. was importing 7.47 million b/d of crude oil and petroleum products, or 43.4% of total demand, as 1992 approached. Forecasters warned the volume will continue to rise as U.S. production declines.

East Coast states' dependence on imported oil will increase sharply in this decade, the Coalition for American Energy Security (CAES) predicted in October 1991. It said by 2000 New England's reliance on imported oil will increase from the current 91% to 98%. Middle Atlantic states will



U.S. West Coast oil supplies*

Table 4

Source	1976	1980	1990	2000	2006	2010
	Million b/d					
Alaska	0.20	1.00	1.50	1.00	0.70	0.50
California	0.90	1.00	0.90	0.80	0.70	0.60
Imports	1.00	0.40	0.20	1.10	1.60	1.90
Total	2.10	2.40	2.60	2.90	3.00	3.00
	%					
Alaska	10	42	58	34	23	17
California	43	42	35	27	23	17
Imports	47	16	7	39	54	66
Total	100	100	100	100	100	100

*West Coast defined as Petroleum Administration for Defense Dist. 5: Alaska, Washington, Oregon, Nevada, California, Arizona, and Hawaii.

Source: Bruce Wilson from California and Alaska state data

on products shipments from other sections of the country and from overseas. Wilson predicted South Atlantic region demand will grow from 2.3 million b/d in 1990 to 2.6 million in 2000. And by the turn of the century, more than 75% of the oil delivered to the South Atlantic will be imported. Domestic crude supplies to the region will fall to less than half of the 1980 level.

Wilson said Florida will be affected most because of its high gasoline demand. Because Florida is the only state in the region not supplied by a pipeline, it relies on waterborne shipments for all of its oil.

But as demand increases in other states, U.S. refineries are likely to cut waterborne shipments first, redirecting them to pipeline deliveries, which are less expensive and risky, Wilson said.

In May 1991 CAES released a Wilson study saying that without a major new oil discovery in Alaska, Pacific Coast

states again will become largely dependent on imported oil by 2010, when imports will account for 66% of their supplies (Table 4).

The study noted that in the mid-1970s Alaskan North Slope (ANS) production replaced similar grade oil from the Persian Gulf in West Coast refineries. But Prudhoe Bay field production peaked in 1989 and is due to drop dramatically by the end of the 1990s.

After North Slope production began to decline, falling output was at first offset by reduced shipments to the eastern U.S. But when reduced ANS production hits the West Coast in earnest, the decline will be absorbed mainly by California, Hawaii, and, to a lesser degree, Washington.

Wilson's study said ANS crude will be replaced by Persian Gulf oil because they are similar chemically, and refineries can switch to Arabi light without incurring more capital expenses.

California, Nevada, and western Arizona will be 50% dependent on imported oil by 2000, and Washington-Oregon will be 66% dependent by then. Hawaii will become totally dependent on non-U.S. oil by 1996. That state in 1991 received 50,000 b/d of oil from Alaska, or 38% of its supply.

ANS crude has not been widely used in Hawaii because the two refineries there are geared to process high gravity, low sulfur, imported crude that is well suited for Hawaii's petroleum product mix—jet fuel accounts for 44% of the state's total requirements—and there are stiff sulfur emission rules.

The report was the first in a series of regional oil import dependence studies prepared for CAES, which was formed to push for leasing of the ANWR Coastal Plain. Its members included oil companies and oil industry associations, as well as other groups.

Gas pipelines set the pace

Gas transmission lines set the pace for U.S. pipeline construction in 1991. Pipeliners had their sights set on construction of 4,858 miles of gas transmission or gathering lines 4 in. and larger in 1991 and beyond. By contrast, plans

New and potential federal environmental costs to the U.S. oil industry

Requirement	Effective date	Initial cost	Annual operational cost Million 1990 \$	Total annualized cost
AIR				
Benzene Neshaps*	March 1992	2,000	NA	235
Phase II Rvp reductions	May 1992	NA	NA	464-1,490
Diesel fuel sulfur reduction	Oct 1993	3,313	340	360-1,170
Stage II controls at service stations†	1995	NA	NA	193-324
Clean fuels	1992-2000	3,000-4,000	NA	1,372-7,924
Air toxic—MACT§ standard†	1992-2010	2,944	614	1,041
Marine vapor control‡	1994	2,362-3,052	362-389	629-745
WASTE				
Primary sludge listing	March 1991	42-407	54-103	51-131
Toxicity characteristic	1990-91	NA	NA	2,671-5,549
Corrective action at hazardous waste facilities	1995	NA	NA	14-90
WATER				
Double hulls on U.S. tankers	1995-2015	3,991	178	712
Effluent limitations and new source performance standards	1993	76-2,583	46-646	54-949
Marine spill response	Feb 1993	435	100	151
Ban on surface discharge‡	1997	0-1,868	0-362	0-581
Underground injection control‡	1994	0-21,683	77-529	77-3,076
TANKS				
Underground storage tanks	1989-1998	NA	NA	1,173
SPCC¶ program for aboveground tanks †	1994	896-11,722	00-408	146-1,834
Secondary containment for aboveground tanks†	1994	4,131-5,825	0	435-624

*National emission standards for hazardous air pollutants program. †Specific requirements are expected from a federal agency but have not yet been proposed. ‡Maximum achievable control technology. §Spill prevention control and countermeasures program.

Source: American Petroleum Institute

paign in defense of diminishing U.S. operations of major oil and gas companies. API and oil company executives acknowledged with alarm the accelerating shift of major company exploration and production activities away from the U.S. And they slammed government policies encouraging the migration.

The major producing industry isn't abandoning the U.S., declared Allen E. Murray, outgoing API chairman and chairman, president and chief executive officer of Mobil Corp. "It's being thrown out," he told a news conference.

Murray and other speakers warned that the costs of

burgeoning environmental regulations will damage U.S. economic interests in an increasingly competitive world. To punctuate the message, API released a study estimating that by the late 1990s, new or potential environmental regulations will raise petroleum industry costs, including annualized costs of required investments, by \$15.23 billion/year (Fig. 2). By comparison, profits of 22 of the largest U.S. oil companies totaled \$21.3 billion in 1990.

Estimated petroleum industry costs represent 12-17% of what API expects to be total national environmental outlays in 2000. The study noted that its cost estimates are by

Table 1

Oil and gas completions and footage for gulf areas

	Oil well completions					Gas well completions				
	Alabama offshore	Gulf of Mexico northern federal waters	Louisiana offshore	Texas offshore	Total Gulf of Mexico	Alabama offshore	Gulf of Mexico northern federal waters	Louisiana offshore	Texas offshore	Total Gulf of Mexico
1981	NA	4	10	9	163	NA	0	207	72	279
1982	NA	17	113	17	147	NA	10	196	94	300
1983	NA	3	231	21	165	NA	8	124	129	261
1984	0	6	310	2	318	1	1	278	75	355
1985	0	7	139	22	168	3	3	150	90	246
1986	0	16	159	10	185	1	2	117	90	210
1987	0	24	163	9	196	1	2	106	35	144
1988	0	13	141	1	155	1	12	113	57	183
1989	0	47	205	13	265	0	26	293	154	475
1990	0	16	243	33	292	3	10	305	137	455
1991*	0	17	75	8	100	3	9	154	69	235

	Oil well footage					Gas well footage				
	Alabama offshore	Gulf of Mexico northern federal waters	Louisiana offshore	Texas offshore	Total Gulf of Mexico	Alabama offshore	Gulf of Mexico northern federal waters	Louisiana offshore	Texas offshore	Total Gulf of Mexico
1981	NA	47,329	1,412,245	80,713	1,540,287	NA	0	2,112,923	679,994	2,792,917
1982	NA	183,832	1,117,360	171,734	1,482,926	NA	123,817	1,991,511	824,041	2,939,369
1983	NA	158,276	2,264,523	187,287	2,610,086	NA	91,322	1,430,347	1,189,822	2,711,491
1984	0	56,310	2,952,490	15,953	3,024,753	21,000	10,275	2,658,371	707,151	3,396,797
1985	0	75,900	1,402,400	195,600	1,673,900	64,000	27,400	1,540,400	907,800	2,540,000
1986	0	176,320	1,457,400	96,602	1,730,322	22,390	15,481	1,298,367	998,752	2,334,990
1987	0	260,845	1,534,846	100,091	1,895,782	21,710	21,128	1,168,353	376,961	1,588,152
1988	0	131,995	1,306,788	10,200	1,448,983	22,950	92,553	1,171,555	593,957	1,881,415
1989	0	504,356	1,861,900	126,060	2,492,316	0	254,838	2,915,083	1,499,214	4,669,135
1990	0	169,057	2,405,389	327,070	2,901,516	27,272	103,962	2,875,241	1,183,752	4,190,227
1991*	0	188,198	673,543	72,227	933,968	9,701	99,413	1,605,862	652,210	2,367,186

*1991 well completions and footage through October.

Sources: Rig count — Baker Hughes Inc.

Well completions — American Petroleum Institute

Data provided by Oil & Gas Journal Energy Database

Ann gas processing plant in southern Mobile County, Ala.

In November 1991, Mobil began producing about 40 MMcf/d of Norphlet gas from a well on Mobile Block 823, 4 miles south of Dauphin Island, the first production in federal water off Alabama. Altogether, Mobil drilled six wells in Block 823 field, with one flowing 62 MMcf/d of gas.

Operator Mobil has a 50% interest in Block 823 field. Texaco 25%, Conoco 12.5%, Exxon 7.5%, and Agip 5%.

Exxon was well along with plans to spend \$3 billion to start Norphlet gas production in Mobile Bay, where its leasehold surrounds Mobil's Mary Ann development. By late 1993, Exxon expects to begin moving about 300 MMcf/d of gas from 12 Norphlet wells to an onshore treating plant in southern Mobile County.

Also in state water, Arco Oil & Gas Co. installed a platform just north of Dauphin Island to produce about 70 MMcf/d of Miocene gas at 2,000 ft. Production through the facility was to begin in December 1991.

In late December 1991, Unocal Exploration Corp., the largest acreage holder in the gulf OCS off Alabama with 83,563 acres in 24 blocks, announced a Norphlet gas discovery on Mobile Block 916, about 40 miles southeast of Mobile.

Unocal's 2 OCS-G 5753 well flowed 41 MMcf/d of gas through a 5-in. choke with 4,368 psi flowing tubing pressure from 248 ft of perforations below 22,700 ft. The find extended the Norphlet play south.

Operator Unocal and Chevron each own a 45.65% interest in the find and Bechtel Energy Resources Corp. 8.7%. The partners hold identical interests in seven federal blocks

covering more than 40,000 acres around Block 916.

Chevron early in 1991 disclosed a Norphlet discovery below 21,000 ft on Destin Dome Block 56 in the gulf's eastern planning area, capping a 3 year search. The discovery well flowed 22 MMcf/d of gas.

Operator Chevron and Conoco each own a 33.33% interest in the well and Murphy Oil Corp. and its Odeco subsidiary 16.67% each.

Chevron's leasehold in the vicinity, covering 35 federal tracts and one state tract off Florida, was concentrated in three segments: Destin Dome 56, Mobile Blocks 861 and 916. Chevron expects to begin production on Mobile 861 in 1994, with Mobile 916 and Destin Dome 56 coming on line in 1996. Drilling in the area is expected to continue until 2001.

Other activity

In other gulf action during 1991:

- On South Marsh Island Block 147, Phillips Petroleum Co. in the second quarter completed three wells and tied them back to a platform installed on the tract in 1990. Block 147 production by yearend had reached 92 MMcf/d of gas and 4,000 bbl of condensate.

A fourth Phillips well on the acreage was awaiting completion at yearend. Two or three more wells are planned for 1992 on Block 147.

Phillips also participated in two projects in the Ship Shoal area that advanced during 1991.

In November on Ship Shoal Block 149, Phillips installed a

Table 2
Baker Hughes active rig count

	Central gulf	Western gulf
1981	154	74
1982	137	78
1983	124	48
1984	132	55
1985	129	48
1986	69	19
1987	65	19
1988	88	22
1989	72	22
1990	76	22
1991*	57	15

*1991 is average rigs through November.

Source: Baker Hughes Inc.

Data provided by Oil & Gas Journal Energy Database

pays at 8,000-13,000 ft. About eight wells/year for the next 3-4 years are planned on the acreage.

In south Timbalier 205/206 field, operator Amerada Hess and Phillips in February completed initial development with the prospect's 12th well. Field production reached a year-long high in October with production of 160 MMcfd of gas.

Gulf-wide in 1991, Phillips participated in nine exploratory well and 26 development wells.

- Marathon Oil Co. drilled a discovery well on its Lobster prospect in 775 ft of water on Ewing Bank Block 873. At yearend, Marathon was drilling the tract's third delineation well.

Marathon also drilled a discovery well and two delineation wells in 370 ft of water on South Pass Block 87.

Operator Marathon, with a 66.67% interest, estimated South Pass 87 reserves at 80 million BOE in sands at 9,500-13,000 ft. The company plans to set a platform and begin production in 1994.

The first South Pass 87 delineation well was drilled to 16,715 ft from a surface location 2,300 ft southwest of the discovery well. The well cut 82 ft of oil and gas pay and established a hydrocarbon column extending over a 600 ft structural interval.

Marathon at yearend was drilling a second delineation well through a template at the first delineation well to a bottomhole location 4,500 ft west and 800 ft downdip of the discovery well. Pending further delineation of the South Pass 87 discovery, Marathon tentatively plans to install a platform in 1994.

Operator Marathon, Amerada Hess Corp., and OKC Limited Partnership each own one-third interests in the tract.

In a separate South Pass area project, Marathon participated in two more delineation wells from a subsea template on Block 86 to a 70 million BOE field on Block 89. Since drilling the South Pass 89 discovery in 1988, Marathon has drilled and suspended five wells from the template.

Marathon and partners planned to install a platform on South Pass 89 early in 1992, with production beginning at midyear. Liquids production is expected to peak at more than 20,000 b/d. Gas facilities are designed to handle as much as 100 MMcfd.

Operator Marathon, Amerada Hess, OKC, and Louisiana Land & Exploration Co. each own a 25% interest in the development.

Gulf-wide in 1991, Marathon participated in 12 explor-

production platform and at yearend was hooking up two wells drilled in 1990. Pliocene oil production was expected to peak at 1,000 b/d from pay at 5,000-6,000 ft.

Phillips owns 85% to 100% interests in the field.

In Odeco-operated Ship Shoal Block 113 field, partners drilled four development wells and two field extensions. Production is from multiple Miocene-Pliocene

and nine development wells, making it one of the few gulf operators to increase its emphasis on exploratory drilling. The company participated in five exploratory and 15 development wells in the gulf in 1990 and five exploratory and 12 development wells in 1989.

- Texaco U.S.A. in August launched the jacket and installed the deck for its Tick platform in 750 ft of water on Garden Banks Block 189. It is the deepest water Texaco operated platform in the world.

At yearend, Texaco and Unocal, 50-50 partners in the project, were awaiting a permit from MMS to lay an 8 in. pipeline from Tick platform to the High Island Pipeline system about 28 miles away.

Tick production is expected to peak at 10,000 b/d of oil and 60 MMcfd of gas from Pleistocene sands at 5,000-8,000 ft.

Texaco participated in 44 wells in the gulf during 1991, 26 wildcats and 18 development wells. Because of low gas prices, the company favored liquids prospects.

- Mobil participated in development on Ewing Bank Block 826, Eugene Island Block 330, and Green Canyon Block 18.

It completed initial development on Ewing Bank 826 with four appraisal wells to Pliocene-Pleistocene oil sands at 10,000-13,500 ft in 480 ft of water.

Mobil also completed initial development of Green Canyon 18 with two flexure trend wells drilled to Pliocene/Pleistocene sands at 8,000-13,500 ft in 760 ft of water.

It participated in six exploitation wells in Pennzoil-operated Eugene Island 300 field. The wells went to Pleistocene oil and gas sands at 4,000-8,000 ft in 250 ft of water. Mobil owns a 25% interest in the field.

Gulf-wide in 1991, Mobil participated in 33 development wells—17 Mobil operated—and five exploratory wells.

- Arco finished rebuilding B platform in South Pass Block 60 field.

B platform, the hub of South Pass 60 field, was damaged by an explosion and fire in March 1989 that cut production to 8,000-10,000 b/d of oil from 18,000 B/d. The new installation restored production to 20,000 b/d.

On South Pass Block 52 field, Arco installed a tripod platform in 550 ft of water.

Production from Pliocene sands at 9,000-10,000 ft was to begin in January 1992. The company planned to drill three wells from the platform using a new minimum area rig concept by Helmerich & Payne.

Arco's overall strategy in the gulf in 1991 continued to focus on being a low cost producer. But low gas prices meant the company had to delay or drop some projects. Low gas prices also prompted Arco to curtail drilling and place more emphasis on oil prospects.

Arco drilled 44 wells in the gulf during 1991, including 20 exploratory and 24 development wells. In 1990, the company drilled 55 gulf wells.

- Nerco Oil & Gas Inc. and CNG Producing Co. installed a four pile platform in 198 ft of water on West Cameron Block 554 field and began producing gas at a rate of 12 MMcfd. Block 554 field production was expected to increase to 50 MMcfd early in 1992. The \$9.5 million platform has a design capacity of 100 MMcfd.

Nerco and CNG planned more delineation and exploratory drilling from the platform in 1992.

A delineation well by Nerco and Agip Petroleum Co. in 419 ft of water on Vermilion Block 395 cut more than 400 ft of net pay in five Pleistocene intervals. Partners began engineering for an unmanned platform, pending a finding of commercial capacity.

Nerco and Agip in November installed a platform in 467 ft of water on nearby Vermilion Block 412, where production was scheduled to begin early in 1992.

The partners hired OPI International Inc. for the installation and to lay a 16 in. gas pipeline 7.65 miles between a

Table 1
Breakout of net income

	1989	1990	Change	%
	Billion \$			
INTEGRATED COMPANIES AND REFINERS				
Upstream	0.7	1.0	0.3	+ 61
Downstream	0.9	0.9	—	+ 3
Other*	-0.4	-0.5	-0.1	—
Subtotal	1.1	1.4	0.3	+ 27
OIL AND GAS PRODUCERS				
Upstream	—	0.7	0.7	—
Downstream	0.1	—	-0.1	- 34
Other*	0.1	0.2	0.1	+ 68
Subtotal	0.2	1.0	0.8	+ 370
Total	1.3	2.4	1.1	+ 81

*Net income generated by foreign activities and other Canadian operations.

Source: Petroleum Monitoring Agency

Table 2
Breakout of spending

	1989	1990	Change		Share of total	
	Billion \$			%	1989	1990
					%	%
UPSTREAM						
Exploration	2.5	2.6	0.1	4	32	30
Development	0.8	1.0	0.2	23	10	11
Production	1.9	2.1	0.2	7	24	24
Nonconventional*	0.4	0.7	0.3	73	5	8
Subtotal	5.7	6.4	0.7	13	72	74
DOWNSTREAM						
Other energy-related	1.3	1.1	-0.2	-12	16	13
All other	—	—	—	-36	—	—
Subtotal in Canada	0.4	0.4	—	9	5	5
Spending abroad	7.4	8.0	0.6	8	93	92
Gross total	0.5	0.7	0.2	22	7	8
Receipts†	7.9	8.6	0.7	9	100	100
Net total	0.2	0.1	-0.1	-59		
	7.7	8.6	0.9	11		

*Includes oilsands and nonconventional heavy oil projects. †Includes incentives, grants, tax credits, and other receipts.

Source: Petroleum Monitoring Agency

outlays abroad rose 22% to \$655 million. Spending abroad, as a share of total capital spending was up 1 percentage point to 8% of the total in 1990.

Upstream spending remained the largest component of total capital outlays, accounting for 74% in 1990 up 2 percentage points from 1989. Downstream spending declined 12%, while other outlays rose 5%.

PMA said the crude oil price rise resulting from the Persian Gulf crisis seemed to have caused a slight increase in capital outlays during the latter part of 1990. Capital spending, especially for development projects, rose in an effort to bring new production on stream.

Upstream outlays by Canadian controlled companies increased 27.1% to \$3.337 billion, while those of foreign controlled companies rose only 1% to \$3.087 billion. The Canadian controlled group of companies' share of upstream capital spending rose 6 percentage points to 52% of the total in 1990.

Increases in spending for the Bi-Provincial Upgrader, classified with oilsands outlays, accounted for most of the increase of 73% in capital spending in the nonconventional sector. As a result, upstream capital spending increased 13% to \$6.4 billion in 1990.

The 46,000 b/d capacity upgrader, carrying a price tag of \$1.3 billion, was under construction at Wilton, Sask., by a combine of Husky and three Canadian governments. The group aimed for a mid-1992 start-up to convert heavy crude oil and bitumen from the Lloydminster and Cold Lake area and distillate from Husky's Lloydminster refinery to high grade synthetic crude. Husky is operator with a 26.67% interest. Its partners are the federal government with 31.66%, Alberta 24.17%, and Saskatchewan 17.5%.

Alberta's holiday on royalty

The Alberta government's royalty holiday suspended requirements for royalties of as much as 25% on newly completed oil wells for as long as 2 years in response to industry pleas for aid. Provincial Energy Minister Rick Orman announced the move and said the government was studying industry requests for changes in Alberta's royalty structure.

Orman said the royalty holiday may eventually increase royalty revenues by increasing oil production.

The royalty incentives apply to oil wells only and vary according to well type. Suspended wells will qualify for a 5 year royalty holiday if reactivated by Apr. 1, 1993.

New wells drilled by the same date in remote or costly operating areas of northern Alberta and the Rocky Mountain Foothills qualify for 2 year royalty holidays. New wells in other areas have a Mar. 31, 1992 deadline to qualify for a 2 year holiday and will get a 1 year holiday if drilled after that date. They must be at least 1½ miles from existing wells but can be in the same field.

Development wells drilled by Mar. 31, 1993 will get a 1 year royalty holiday with a ceiling of \$400,000.

The program, administered by the Alberta Energy Resources Conservation Board, drew mostly a welcome response from industry.

The Independent Petroleum Association of Canada said it will have a positive effect on exploration economics and increase winter drilling activity. The Canadian Association of Oilwell Drilling Contractors said the change will provide



The 1990 export performance increased Canada's share of the U.S. gas market to an all time high of 7.7% from 7.1% in 1989, 7% in 1988, 5.9% in 1987, and only 4.6% in 1986.

Pushing gas as a motor fuel

Canadian Federal Energy Minister Jake Epp in October 1991 launched the Natural Gas Vehicle Refueling Appliance Program, financed at \$4 million, to encourage the use of natural gas as a transportation fuel.

Under the program, the federal government will contribute a \$1,500 package for conversion of a vehicle to natural gas and installation of a vehicle refueling appliance.

The package includes a \$500 conversion grant available through the existing natural gas vehicle program and a \$1,000 payment toward purchase of a natural gas vehicle appliance.

Funding will come from market development incentive payments, money made available to the federal government by Alberta gas producers to expand the markets for Alberta gas in Canada. The program will operate in Alberta and provinces to the east where Alberta natural gas is available.

Epp disclosed the program at the official opening of the new Fuelmaker Corp. factory in Toronto. Fuelmaker manufactures natural gas vehicle refueling appliances. It is a joint venture of B.C. Gas, Sulzer Canada Inc., and Questar Corp., Salt Lake City.

Sale of shares in Petro-Canada

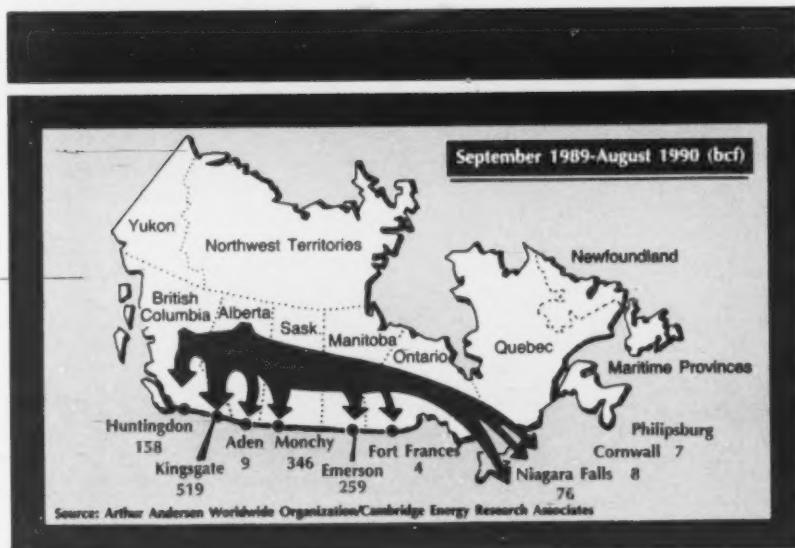
A public offering of 39.5 million shares in Canada's state oil company at \$13 share was sold out in summer 1991, netting the federal government \$513.5 million.

The 42 million shares sold represented about 19.5% of the company. The sale was the first step in federal efforts to privatize Petro-Canada, Calgary.

The share price was set at \$13 instead of an expected \$15 in light of losses earlier in the year. Analysts estimated the company's net asset value at \$26.48 share.

About 8.2 million shares were sold to foreign investors and 2.5 million shares to Petro-Canada employees. The rest were sold to individual Canadian buyers and institutional buyers.

Proceeds were to be applied to Petro-Canada's short term debt and its 25% share of development costs for Hibernia oil field on the Grand Banks off Newfoundland.



Great Lakes Gas Transmission Co.'s system adds capacity to carry more Canadian gas to the U.S. Midwest and Northeast. Construction by the 50-50 venture of Coastal Corp. and TransCanada PipeLines Ltd. is part of industry's campaign to step up gas sales.

China's buildup in production

	Million metric tons of oil
1982	102.0
1983	106.0
1984	114.6
1985	124.9
1986	130.7
1987	134.0
1988	137.0
1989	137.6
1990	138.0

Source: China Features from China National Petroleum Corp. data

were planned. With the offshore extension, Zhao Liusheng, field deputy chief geologist, estimates the area's potential reserves at as much as 1 billion bbl.

Bohai offshore production climbed to 24,000 b/d from three fields developed by a Sino-Japanese joint venture. The most recent Bohai start-up, Chengbei, produced 8,000 b/d. Three other fields are under development, and Bohai production was expected to climb to 40,000 b/d of oil and about 48 MMcf/d of gas.

State-owned Bohai Oil Co. signed seven contracts with multinational oil companies covering more than \$700 million in foreign investment.

East China Sea gas

Shanghai planned to take delivery of natural gas from Pinghu oil and gas field in the East China Sea for residential consumption.

Du Yuanshun, director of Shanghai Public Utilities Bureau, told China Daily the city was prepared to use 5.96 MMcf/d of gas, equal to production of Pudong Gasworks, for 10-15 years.

Only 54% of the urban households have a gas supply, although the city supplies residents with 176.5 MMcf/d.

The plan calls for an investment of about \$300 million, which will come from state loans and foreign governments and banks.

Shanghai expects to invest 3 billion yuan to promote utilization of domestic natural gas.

The East China Sea may prove to be the next area of joint venture participation with foreign oil companies.

Previously reserved for the Ministry of Geology and Mineral Resources, exploration in the East China Sea also will be undertaken by Cnooc, reports China Features (Q) Daqing.

The ministry began seismic surveys in the region in 1974 and spudded the first well in 1985. Of 16 exploratory wells drilled, eight have yielded commercial oil or gas and six hydrocarbon shows, Qi wrote.

The ministry continues to operate a seismic vessel built in the U.K. and outfitted in the U.S. to conduct 2-D and 3-D surveys in the East China Sea. The ministry drilled another three appraisals in the area in 1990. Plans call for preliminary development of Pinghu oil and gas field during 1991-95 with full scale development slated for 1996-2000, Qi wrote.

South China Sea

Exploratory drilling in the South China Sea slumped from the brisk pace of the early 1980s, but two multinational companies showed fresh interest in the area, and several key fields in the Pearl River estuary were expected to begin

Production in China's major fields

Area	1989	1990	First half 1991			
	Oil		Percent of annual plan	Gas—Billion cu m	Percent of annual plan	
	— Million	metric tons				
Daqing	55.55	55.62	27.70	49.9	11.00	51.4
Shengli	33.35	33.50	16.60	49.6	8.00	55.1
Liaohai	13.35	13.60	6.80	49.4	9.00	54.9
Xinjiang Zhongyuan	6.40	6.60	3.40	48.3	2.70	—
Huabei	6.98	6.30	2.90	48.7	6.36	50.1
	5.49	5.35	2.60	51.4	1.20	45.9
Dagang	4.06	3.83	1.90	50.2	1.60	47.1
Jilin	3.41	3.55	1.70	50.6	0.60	—
Henan	2.55	2.52	1.20	49.3	0.16	—
Changqing	1.43	1.46	0.80	50.3	0.18	—
Cnooc*	0.90	1.26	1.12	62.5	—	—
Jiangsu	0.80	0.85	0.40	49.2	0.17	—
Qinghai	0.73	0.80	0.50	51.2	0.38	—
Yumen	0.54	0.54	0.30	45.5	0.19	—
Jiangnan	0.39	0.38	0.40	52.4	0.28	—
Jidong	—	0.35	0.20	50.0	0.12	—
Sichuan	0.12	0.13	0.07	60.3	32.30	50.9
Tarim	—	0.15	0.30	68.5	—	—

*All offshore.

Source: China Features from China National Petroleum Corp. data

producing in 1991.

BP Exploration China and Norway's Den norske stats oljeselskap AS expressed a renewed interest in the South China Sea, south of Guangzhou, and in an area to the west, south of Hainan Island.

By 1995 South China Sea production is expected to reach 120,000 b/d, making it the country's top offshore crude producing area and sixth largest overall.

Chinese and foreign companies conducted 64,581 line km of seismic surveys in the area, found 19 fields, and drilled 86 wells, of which 25 yielded oil.

At least five oil fields are expected to begin producing in 1991-95.

Although plagued with technological problems, Lihua 11-1 field is considered the most exciting discovery in the area. Oil in place is pegged at 700 million to 1.4 billion bbl, making it the largest producing complex off China. Xu wrote. China signed a contract with Amoco Orient Petroleum Co. to jointly develop the field, expected on stream in 1992 with initial production of 6,100 b/d from six wells.

Huizhou 26-1, a 1988 discovery by ACT Group, was put on stream in late 1991. Original oil in place is estimated at 150 million bbl.

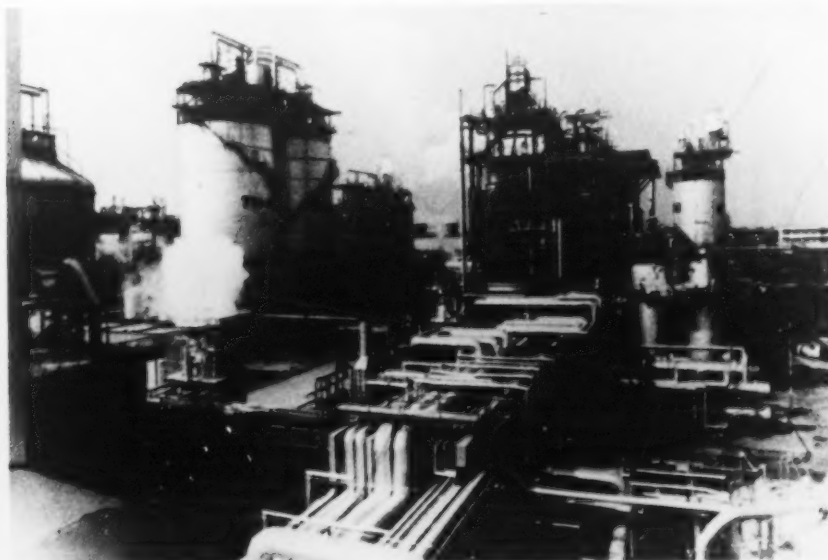
Production facilities have been installed in the area near Huizhou 26-1 and an earlier discovery, Huizhou 21-1, that include a platform for primary gas-liquid separation, a floating production-storage tanker, and a turret moored loading buoy. Production from the 39 million bbl Huizhou 21-1 was expected to peak in 1991 at about 29,000 b/d.

Development of Huizhou in 1988-89 entailed drilling 15 wells through a seabed template installed in 381 ft of water. It produces from 10 wells tapping six sands at 2,800-3,000 m. Another four wells are water injectors.

Combined peak production of the two fields is projected at 80,000 b/d in 1992.

Another discovery, ACT's Huizhou 32-2-1, just 10 km from Huizhou 26-1, may be tied back to those other Huizhou production facilities.

It flowed 15,000 b/d in 1991.



Oxygenating unit in the No. 2 polyester plant at the Shanghai petrochemical complex. The complex is poised for a significant expansion of exports. Photo by China Features.

Shanghai petrochemical complex

Unit	Capacity (1,000 metric tons/year)	Unit	Capacity (1,000 metric tons/year)
Phase 1, 1972-76			
Atmospheric/vacuum distillation	2,800		
Ethylene	115		
Acetaldehyde	30		
Acrylonitrile	50		
Acetic acid	35		
Paraxylene	17		
Polyvinyl alcohol (PVA)	33		
Formaldehyde	15		
Low density polyethylene	60		
Polyacrylonitrile	50		
Polyester	25		
PVA blending	30		
LDPE film	14		
Polyacrylic blending	50		
Polyester blending	11		
Phase 2, 1980-86			
Hydrocracking		900	
Hydrogen		43	
Platformer		400	
Paraxylene		150	
Terephthalic acid		225	
Polyester		200	
Polyester blending		100	
Phase 3, 1987-92			
Atmospheric/vacuum distillation		2,500	
Ethylene		300	
Ethylene glycol		120	
Polypropylene		140	
LDPE		80	

when it developed 20,000 and 10,000 ton/year ethylene cracking furnaces designed by Chinese engineers. Sinopec said the units show that China has the ability to design, build, install, and operate large ethylene cracking furnaces. A catalytic pyrolysis unit, which mainly makes propylene, was developed by the company and tested in 1990.

"It is a breakthrough in the conventional technology of high temperature steam cracking, opening a new path for producing olefins," Sinopec said.

"These achievements, together with the technology of long residuum catalytic cracking and mild hydrocracking developed and commercialized in earlier years, mark the stepping up of China's petroleum refining and petrochemical technology to a new high level."

Its recent work building new production units and improving existing heavy oil catalytic cracking, hydrocracking, coking, and visbreaking units allowed the company to increase bottoms upgrading capacity 60% and the yield of light oil products by 5% compared with 6 years ago.

Production of 90 octane and higher gasoline accounted for 35% of all gasoline produced in 1990 in China. Sinopec

says it reached that level by building and reconfiguring a number of catalytic reforming, alkylation, methyl tertiary butyl ether, and other units.

Production of high and medium grade lube oil was increased, totaling 57% of all China's lube products manufactured last year.

And Sinopec's capacity to produce polypropylene from refinery gas reached 300,000 tons/year during 1990.

Large refinery studied

France's Ste. Nationale Elf Aquitaine and partners will step up the pace of feasibility studies for construction of a large refinery in the Padong area, near Shanghai, China.

The action followed a visit to China by Elf Pres. Loik Le Floch-Prigent.

Studies were in a very early stage in partnership with China's Sinopec and others.

Elf meantime, signed a trade agreement with National Chemicals Import & Export Corp. (Sinochem) calling for a 3 year, \$1 billion exchange of crude oil, petroleum products, chemicals, and pharmaceutical raw material.

Construction of the joint venture refinery under study could make Elf the second western company to enter China's refining operations.

France's Total acquired a 20% interest in a joint venture to build a 100,000 b/d export refinery at Dalian, Liaoning province, based on Middle East feedstock.

Elsewhere in China's downstream sector, Royal Dutch/Shell agreed with five Chinese partners to conduct a feasibility study for construction of a \$2.5 billion refining and petrochemical complex at Aotou, Guangdong.

Qinghai-Tibet plateau refinery

Golmud oil refinery on the Qinghai-Tibet plateau in western China is under construction and is to be fully on stream by mid-1995.

The \$88 million, 20,000 b/d refinery will produce about 8,200 b/d of gasoline, 6,750 b/d of diesel fuel, 100 b/d of kerosene, 726 b/d of liquefied petroleum gas, and 23,400 tons/year of propylene.

Kuwaiti business

China was pushing hard for a share of Kuwaiti business

meet 41% of domestic demand, reported Iqbal Haidari in *Economic Review*, a monthly Karachi publication.

Pakistan oil reserves have shot up dramatically in recent years, to about 108.91 million bbl in 1989 from 17.1 million bbl in 1988. Haidari wrote. Oil & Gas Journal estimated Pakistan's oil reserves at 162 million bbl as of Jan. 1, 1991, up from about 118 million bbl on Jan. 1, 1990.

In addition, natural gas now meets 35% of Pakistan's energy needs with production at 1.4 bcf/d, Haidari said.

key to that effort being sustained is Pakistan's campaign to attract more foreign operators through sweetened terms and pared bureaucratic red tape. Economic Review also reported efforts to improve the country's oil and gas infrastructure, notably refining.

Pakistan's crude and refined products import bill in fiscal 1990-91 is expected to total \$1.16 billion. Almost one fourth of the country's foreign exchange earnings are spent on crude and products. In 1981, oil imports accounted for only 10% of Pakistan's foreign exchange earnings. If present energy consumption trends continue, in 5 years Pakistan could be spending more than half its total foreign exchange earnings on crude and products imports. Economic Review said.

Foreign participation

Haidari said an area of 193,700 sq km is under exploration by 29 foreign and local companies with 42 concessions granted in 1988-90 alone.

Principal foreign operators include BP Exploration, British Gas plc, Albion International Resources Inc., Austria's state owned OMV AG, and the local subsidiaries of Texaco Inc., Amoco Corp., Occidental Petroleum Corp., and Unocal Corp.

Pakistan's main oil producing fields are Dhurnal—the biggest—Chak Naurang, Meyal, Finkassar, Leghari, and Thara.

Chief producing gas fields are Sui, Mari, Meyal, Pirkoh, Toot, Dhurnal, Kandhkot, Golrachi, Turk, Loti, Mazari, and Matli. Most Pakistani gas fields are in southern Baluchistan province bordering Iran.

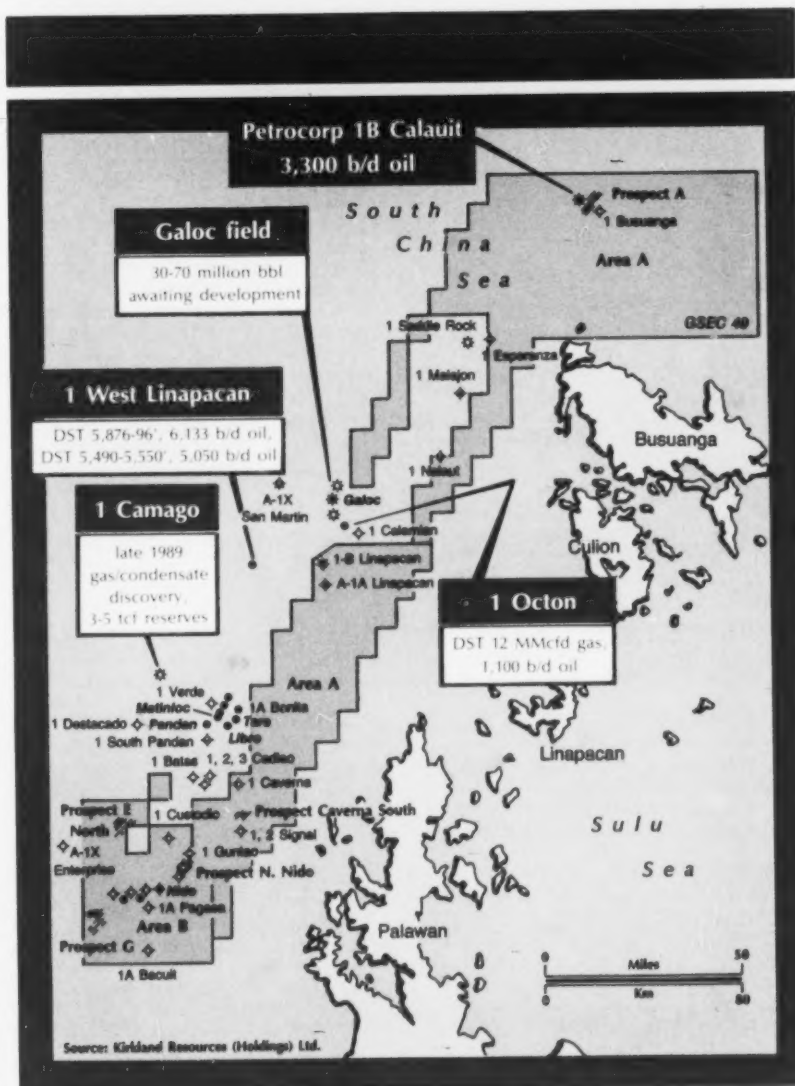
World Bank
loan

The World Bank has agreed to provide Pakistan a \$90 million loan for OGDC exploration, development and related infrastructure work.

It is expected that an additional \$50 million will come from the bank through cofinancing.

The Pakistan government will contribute \$20 million for the program, putting total cost at \$160 million.

The World Bank program calls for development of Dhodak gas field with two development wells, installation of a gas processing plant, construction of a gas pipeline from



Dhodak to Kot Addu to back out fuel oil at the power plant there, and installation of a tank farm for condensate at Dhodak.

In addition, the World Bank program will support exploration and appraisal work in nine current joint ventures for which the Pakistan government and OGDC have continuing commitments.

OGDC also entered joint ventures with oil companies in Pothar Sanghar and other prospective areas.

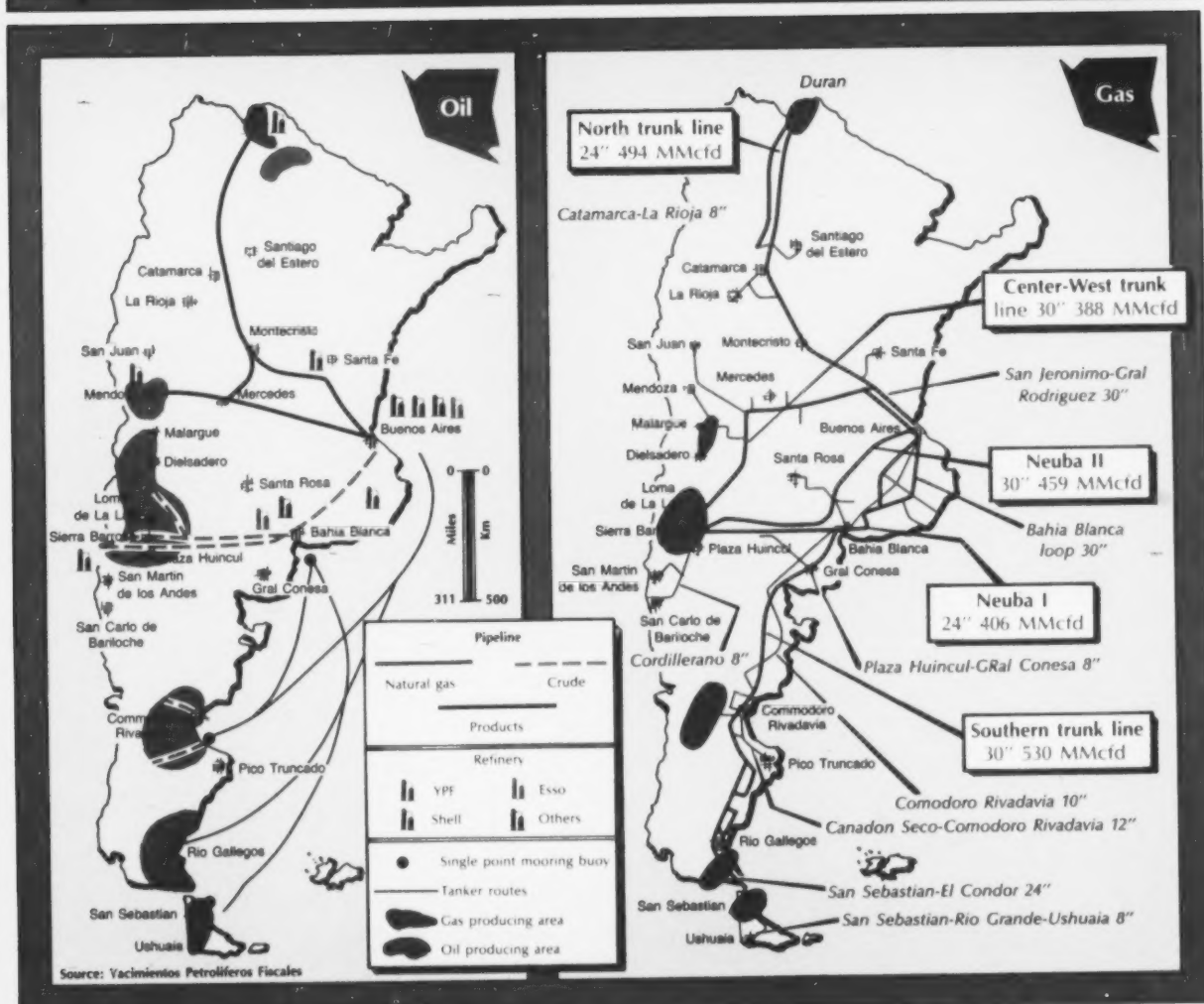
Sweetened terms, reforms

One key to the stepped up foreign presence is an amended income tax law that makes it easier to recover dry hole costs.

Haidari wrote of other government efforts to boost oil and gas activity in Pakistan that include:

- Expediting oil exploration in Baluchistan province
- Accelerating processing and final approval of pending and new applications for exploration licenses
- Increasing refining capacity
- Laying pipelines from Badin and Sanghar oil fields in Sindh province to ensure stable, cheaper transportation

The petroleum infrastructure in Argentina



Peten basin and the Yucatan platform. Its Lower Cretaceous carbonate-evaporite sequence is a direct equivalent to the section of Reforma-Chiapas in Mexico and the Guatemalan Peten oil horizons. What's more, the company said, the presence of several oil seeps, live oil shows in the Cretaceous section of most wells, and subcommercial testing of 30-40° gravity oil in wells in the Belmopan area prove that oil has been generated in the northern Belize basin.

The Nortex license lies on a postulated carbonate-evaporite platform margin with more than 7,000 ft of sedimentary section that has porosity as great as 20-25% in some thick dolomitic intervals capped by anhydrite, particularly in the western part of the block.

Nortex said many live oil shows as well as some gas shows have been recorded in several wells drilled in the vicinity of its license area, and part of the Nortex block lies updip from those wells.

Organic rich marine shales of Jurassic-Lower Cretaceous age, similar to those in Guatemala and Mexico, have been found basinward in Northwest Belize, where they appear to have reached maturity. Nortex considers those shales, interbedded in the evaporite section, the most likely source

for oil in Belize.

Traps would be structural and stratigraphic.

Nortex blames the region's lack of discoveries on earlier poor seismic coverage and poor data quality due to near surface velocity variations and bad density contrast in the sedimentary section. But it said, recent seismic surveys in other parts of the basin with similar problems have yielded much better seismic definition of the structural setting.

BOLIVIA

CAPITAL La Paz
MONETARY UNIT Boliviano
REFINING CAPACITY 45,250 b/cd
PRODUCTION 22,300 b/d
RESERVES 119 million bbl

Activity in Bolivia in 1991

• A joint venture of Diamond Shamrock Inc. and Sol Petroleo SA, Buenos Aires, completed the purchase of Occidental Petroleum Corp.'s and CanOxy's jointly held exploration and production interests in Bolivia.

Ecuador's oil sector at a glance

Oil history

Oil seeps were identified on Ecuador's Santa Elena peninsula in the pre-Columbian era. Indians recovered oil for fuel from hand dug pits in seeps, as did Spanish conquistadors for boiling down to pitch for caulking boats. First modern discovery: Anglo-Ecuadorian Oilfields Ltd. 1 Ancon flowed small volume of oil from Eocene pay at 1,500 ft in 1912. Commercial production established in 1917, limited to Santa Elena peninsula. Santa Elena refineries processed a mix of domestic crude and imported feedstocks, shipping gasoline and diesel by tanker to Guayaquil, then via rail to Quito. Frequent flooding of Guayaquil-Quito railway often knocked out fuel supplies to half the country. In 1967-71, following award of concessions to foreign oil companies, there was a series of discoveries in the Oriente basin of Ecuador's eastern Amazon jungles: Lago Agrio 1967, Aguanico, Sacha, and Shushufindi 1969, and Auca 1971. Construction of Trans-Ecuadorian pipeline linking Oriente fields to the crude export terminal at Balao on the Pacific coast completed in August 1972, making Ecuador a sizable oil exporter. Corp. Estatal Petrolera Ecuatoriana formed in 1972 as a result of new oil laws that led all foreign oil companies except Texaco, Gulf, and City Investing Co. to withdraw from Ecuador. Ecuador joined OPEC in November 1973. CEPE's first project was a small products pipeline from Guayaquil to Quito. CEPE in 1974 acquired 25% of Texaco-Gulf combine operating Oriente fields—a concession dating to 1964—then Gulf's remaining 35.5% stake in 1977, giving it a 62.5% majority stake in the venture. In 1977, CEPE built the 55,000 b/d Esmeraldas refinery to process Oriente crude. CEPE then laid a pipeline to move gasoline and diesel from Esmeraldas to Quito, mothballed the Guayaquil products line, installed storage and distribution facilities in Quito, and laid a products line to Ambato. In addition, CEPE installed a gas processing plant at Shushufindi and a pipeline to move LPG to Quito. Lagging production replacement spurred government to pass new law in 1982 allowing foreign oil companies to undertake exploration under risk/service contracts.

Petroecuador

Holding company successor to CEPE as of September 1989. Permanent affiliates Petroproduccion, Petroindustrial, and Petrocomercial; temporary affiliates Petroamazonas, Petrotransporte, and Petropeninsula to be merged later into related permanent affiliates. Petroproduccion manages exploration and production, Petroindustrial refining, and Petrocomercial marketing. Petroamazonas replaced Texaco as operator for group in Oriente fields, Petrotransporte operates Lago Agrio-Balao pipeline, and Petropeninsula operates Anglo and Repetrol refineries on Santa Elena peninsula.

MAJOR FIELDS

Field	Depth, ft	No. of wells		production b/d	API gravity
		Producing	Total		
Ancon	4,000	439	439	652	35.7
Atacapi	9,855	4	5	1,505	31.0
Auca	10,578	23	24	15,701	28.0
Auca Sur	9,100-10,300	2	2	614	25.6
Bermejo	5,000	21	26	5,475	32.5
Carpet	—	99	99	124	36.4
Cautivo	—	79	79	112	36.4
Charapa	10,000	1	4	291	29.5
Cononaco	11,233	9	11	12,785	33.3
Culebra	10,626	2	2	1,125	17.5
Cuyabeno	8,050	15	19	7,872	27.4
Durenor	—	—	—	—	—
Guanta	9,575-10,290	10	10	7,883	31.0
Fanny	7,700	8	8	4,685	22.5
Lago Agrio	10,175	18	24	8,738	28.5
Libertador	N/A	44	50	37,308	29.7
Mariann	7,700	5	5	1,048	20.0
Parahuacu	10,173	3	5	1,607	30.0
Rumiyacu	10,191	—	1	—	21.0
Sacha	10,180	96	103	63,613	28.0
Shushufindi	9,772	52	60	100,953	30.0
Tarapoa	8,300	1	2	333	20.0
Tetete	9,300	6	11	2,738	29.1
Yuca	10,423	6	7	2,681	28.0
Yuca Sur	9,600-10,000	1	1	351	14.5
Yulebra	8,500-10,000	3	3	1,753	21.4

1990 production 286,918 b/d

Productive capacity 311,000 b/d (3rd quarter 1991 estimate)

1990 production breakout (b/d)

Petroecuador-Texaco 216,985

Petroproduccion (Oriente) 63,900

Petroecuador-City Investing 5,110

Petroproduccion (Santa Elena) 943

1990 field start-ups (b/d)

Pucuna 5,000

Tiguino 3,000

Coca-Payamino 1,700*

*Initial production in early 1991, to reach 11,000 b/d by yearend 1991.



1990 OPEC quota 275,000 b/d

1991 OPEC quota 273,000 b/d

Estimated reserves, 1-1-91 Crude, 1.42 billion bbl Gas, 3.95 tcf

Projected 1991 export crude value \$17/bbl

Oil minister Donald Castillo

GAS PROCESSING

	Gas		Production	
	capacity MMcfd	throughput MMcfd	Normal or unsplit butane 1,000 gal/day	Debut. net. gasoline
Ancon/Santa Elena	16.0	5.5	1.1	5.6
Shushufindi	25.0	15.0	96.0	31.7

REFINING*

	Capacity 1-1-91, b/d				
	Crude	Vacuum distillation	Thermal operations	Catalytic cracking	Catalytic reforming
Esmeraldas	90,000	43,020	25,200	16,000	2,780
Santa Elena/					
Anglo	32,300	—	—	—	—
Amazonas	10,000	—	—	—	—
Santa Elena/					
Repetrol	8,500	—	—	—	—

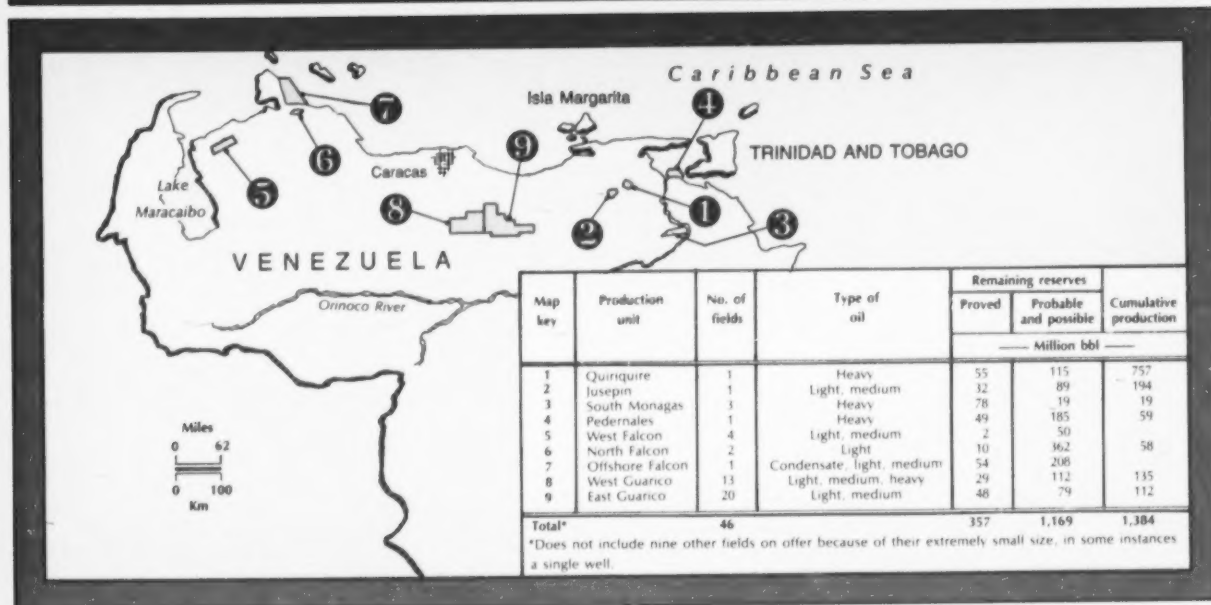
*Also a 1,000 b/d topping plant Texaco operates in Lago Agrio field.

PETROCHEMICALS

Cia. Quimica Borden Ecuatoriana SA's processes methanol to produce 9,200 metric tons/year of formaldehyde, UF resins, vinyl acetate emulsions, plasticizers, and consumer products. Plastigama SA produces polyethylene and PVC pipe, plastic films, and polyethylene rope at Guayaquil.

TRANSPORTATION

Trans-Ecuadorian trunk line, 503 km long and 300,000 b/d capacity, moves Oriente oil to Esmeraldas for refinery or export. A 28 km spur to Colombia's Trans-Andean line was built as alternative export route after March 1987 earthquake almost wiped out Ecuador's crude exports for months. Shushufindi-Quito products line, 304 km and 7,300 capacity, moves LPG from Oriente gas processing plant. Products system, 259 km and 58,000 b/d, moves products from Esmeraldas to Quito then via a 111 km spur to Ambato. An 18 km line moves Santa Elena refined products from a marine terminal at Tree Bocas to storage at Pascuales, near Guayaquil. Total crude and products storage capacity in the country is 1.7 million bbl. Three single point mooring terminals at Balao can handle 100,000 dwt tankers. A fuel oil export terminal at Tetre, near Balao, can handle 25,000 dwt vessels. Crude and products exports are under the auspices of Flota Petrolera Ecuatoriana, LPG shipments by Liquigas, Duragas, Congas, and Autogas.



Linchpin of that effort is a planned \$48 billion investment program for 1991-96 that among other things would have sharply increased Venezuela's output of crude oil and refined products and petrochemicals for export.

What also may be threatened is the momentum toward privatization and increased foreign investment in Venezuela's petroleum sector that was to accompany that expansion program.

The order requires the minister of energy or a shareholders assembly in which the government as single shareholder is represented by the minister of energy to grant prior approval to any decisions in four major areas:

- Establishment, merger, modification, or liquidation of any companies in or outside Venezuela in which Pdysa has an equity interest.
- Contracting of any financial obligations to be used for investments, acquisition of assets, or expenses not included in Pdysa's annual budget.
- Changes in wages or benefits of oil industry employees.
- Naming of top executives.

The new rule covers not only Pdysa but all subsidiaries and companies in which it is an equity partner.

Maraven's Cardon plans

Maraven SA, an operating unit of Pdysa, planned outlays totaling \$1.8 billion for four projects at its Cardon refinery on the Paraguana Peninsula in western Venezuela.

The investments to be made the next 5 years are intended to hike the refinery's capacity to process heavy crudes, produce a slate of higher quality products for export, and meet new environmental rules for refined products in the U.S., the most important foreign market for Venezuelan petroleum exports. The Cardon projects are a

- 60,000 b/d delayed coker scheduled to go on stream at the end of 1994.
- 15,000 b/d hydroprocess unit slated to start up in early 1996. It will use the HDH—hydrogenation and hydroconversion—process developed by Pdysa's research arm Intevep.
- 45,000 b/d capacity naphtha reformer, to begin operation at yearend 1994. Once this unit is working, it will allow

Maraven and affiliate Pequiven to later build an aromatics plant at Cardon.

- 15,000 b/d isomerization unit, to start up at the end of 1994, to boost gasoline octane levels.

Petrochemical plans

Pequiven estimated investments for Venezuela's petrochemical sector would reach \$1.3 billion in 1991.

Hugo Finol, the president of Pequiven, said his company would make direct investments of \$820 million in 1991, while private sector companies from Venezuela and overseas were scheduled to invest an additional \$480 million in joint venture projects.

1991 spending, goals

Pdysa planned to invest a total of 250 billion bolivars (\$5 billion U.S.) in 1991 for exploration, production, refining, transportation, petrochemicals, domestic marketing, and coal. This was the largest amount invested by the Venezuelan petroleum industry in a single year and forms part of a \$34 billion investment in 1991-96.

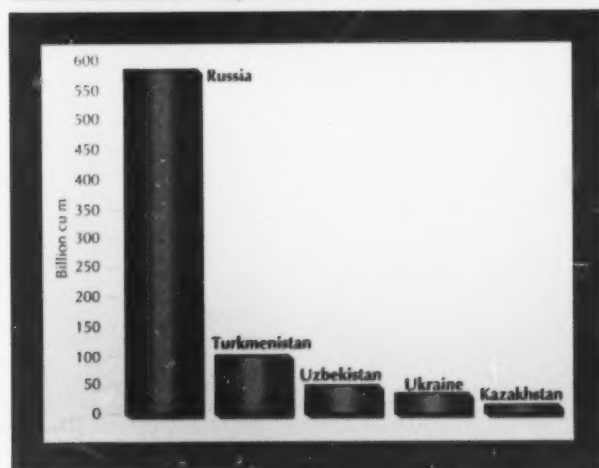
Pdysa also expected to invest \$860 million in U.S. and European refineries where it is owner or a partner.

Pdysa's main targets for 1991 were crude production of 2.5 million b/d and export revenues of \$16.5 billion, working out as an export volume of 1.9 million b/d at about \$20/bbl.

The company planned to maintain its proved reserves of crude oil in 1991 at 58.9 billion bbl, about the same as in 1990. Proved natural gas reserves were expected to reach 21 billion bbl of oil equivalent by yearend.

Other targets for 1991 were crude productive capacity of 2.97 million b/d—up from 2.75 million b/d—Orimulsion production of 34,000 b/d, average refining runs of 1.04 million b/d at Venezuela's six refineries and 195,000 b/d at the unit Pdysa leases in Curacao.

Maraven planned to drill nine wildcats in 1991 and 352 delineation and development wells and conduct 313 workovers. Work was to be concentrated in western Venezuela.



discovered reserves are in the Vendian-Lower Cambrian rocks and more than 35% of the reserves are confined to Mesozoic complexes developed on platform margins.

It is also noteworthy that in the U.S.S.R., as compared with other countries, ancient rock/stratigraphic units are characterized by rather high productivity.

Deep horizons within the U.S.S.R. are not sufficiently explored, the minister said. Only 5% of all discovered oil and 12% of all gas reserves are at depths exceeding 3 km.

The portion of hydrocarbon reserves in nonconventional traps is small. Stratigraphic and lithologic traps contain 17% of oil and 6.7% of gas reserves, reefs contain 2.5% of oil and 5% of gas discovered reserves.

Carbonate reservoirs in the Soviet Union contain only 8% of the oil reserves and 17% of gas reserves (30% of all discovered pools are in carbonates). This is one-half to one-third the share of reserves in carbonates evident in other countries. Carbonates nevertheless are widely spread over the U.S.S.R., particularly in the Pre-Caspian, Timan-Pechora, Volga-Ural, Amudarya, and Leno-Tungusssk provinces.

In most of the U.S.S.R., potential oil and gas resources have been explored to depths of 3.5-4 km.

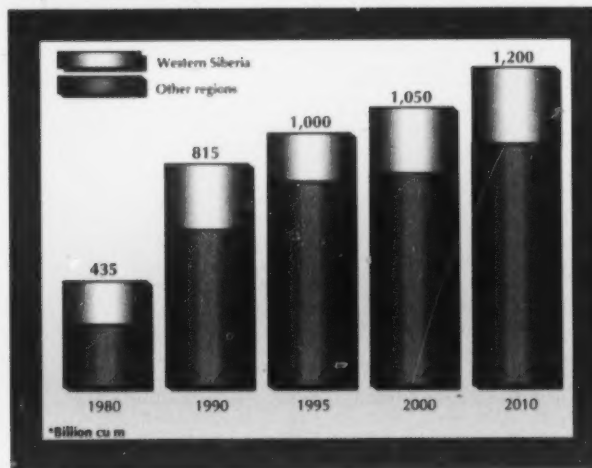
Soviet pipeline construction shows decline

The U.S.S.R.'s long pipeline construction boom has fallen victim to Moscow's severe shortage of funds and the nation's overall petroleum industry decline.

Soviet crews probably will lay fewer large diameter trunk lines during the early 1990s than at any time since the 1960s. That is in sharp contrast with other parts of the world that are undergoing a surge of pipeline construction sparked by rising demand for natural gas.

With oil production plunging and gas flow showing meager growth, the U.S.S.R. currently has little need for added pipeline capacity to move hydrocarbons from western Siberia, its biggest producing area, across the Ural Mountains to European Russia's industrial and population centers.

Even if Soviet oil and gas consumption were surging and exports to markets in eastern and western Europe were increasing strongly, Soviet pipeline construction probably would have slackened off from the frantic pace set in the 1970s through 1987. Besides the shortage of money for new projects, the U.S.S.R.'s pipe production has dropped sharply along with imports, which have been affected by Moscow's inability to pay for some orders filled by foreign



suppliers.

The downturn in U.S.S.R. pipeline building began in 1988, when oil production climbed to record levels and gas flow was continuing to register big gains. Pipe-laying plummeted in 1989 and 1990 and was slated to tumble again during 1991.

Total length of the Soviet pipeline network rose from 200,600 km (124,600 miles) at the end of 1980 to more than 300,000 km (186,300 miles) early in 1990. Length of crude pipelines peaked in 1987, but gas and petroleum products networks have grown slowly during the past several years.

According to official figures, the U.S.S.R. had 35,707 miles of crude oil pipelines at the end of 1980, 42,166 miles at the end of 1987, and 41,172 miles on Jan. 1, 1990. Length of gas pipelines grew from 81,289 miles at the end of 1980 to 132,211 miles by early 1990.

The badly neglected Soviet petroleum products pipeline network increased from 7,576 miles at the end of 1980 to 12,047 miles Jan. 1, 1990.

While the total length of Soviet pipelines jumped by 10,433 miles in 1987, the system gained only 6,396 miles in 1988 and 3,043 miles in 1989. Only 3,664 miles of gas pipeline were completed in 1990 vs. a target of 5,183 miles. Sixteen of the planned 48 compressor stations were placed in service.

During 1991, the U.S.S.R. planned on laying 3,291 miles of gas trunk lines and laterals, according to the official magazine *Gazovaya Promyshlennost* (Gas Industry). The Soviets again hoped to add 48 compressor stations, most of them being facilities not finished as scheduled in 1990.

Increasing numbers of pipeline construction enterprises operated at a loss in 1990, while housing and other amenities for workers were not provided as promised. Big gas pipeline projects were abruptly shut down for lack of funds, especially in western Siberia, and skilled workers were fired or quit their jobs. Besides the lag in gas pipeline and compressor station construction, completion of gas treatment facilities and additional underground gas storage capacity is far behind government goals.

Best long term prospects for major new Soviet gas pipeline construction may be in eastern Siberia and the Far East. But proposals for building long pipelines tapping reserves found recently in remote areas of eastern Siberia's Yakut Autonomous Republic and in the Sea of Okhotsk off the northeast coast of Sakhalin Island would require huge credits from Japan and South Korea.

First pipeline from giant gas fields on western Siberia's

Alaska's oil and gas outlook

Fiscal Year	Cillion b/d										Total AHS	Cook Inlet	State Total		
	NGL	Prudhoe	Kuparuk	Milne Point	Endicott	Lisburne	West Sak	North Star	Niagak	Point / McIntyre				Sag Delta	Schrader Bluff
OIL PRODUCTION OUTLOOK*															
1991	0.058	1.279	0.299	0.018	0.102	0.039	0.000	0.000	0.000	0.000	0.006	0.000	1.801	0.039	1.840
1992	0.061	1.254	0.303	0.018	0.104	0.036	0.000	0.000	0.000	0.000	0.005	0.005	1.787	0.041	1.828
1993	0.056	1.173	0.301	0.017	0.104	0.031	0.000	0.000	0.000	0.000	0.003	0.009	1.694	0.040	1.734
1994	0.053	1.115	0.301	0.017	0.099	0.025	0.000	0.000	0.000	0.054	0.002	0.010	1.676	0.039	1.715
1995	0.051	1.063	0.301	0.015	0.088	0.020	0.000	0.000	0.010	0.083	0.001	0.010	1.642	0.038	1.680
1996	0.047	0.997	0.287	0.013	0.080	0.019	0.000	0.000	0.020	0.089	0.001	0.009	1.562	0.036	1.598
1997	0.044	0.917	0.253	0.011	0.068	0.018	0.000	0.000	0.021	0.089	0.001	0.008	1.429	0.035	1.464
1998	0.040	0.845	0.227	0.009	0.061	0.017	0.000	0.000	0.019	0.083	0.001	0.008	1.310	0.034	1.344
1999	0.035	0.734	0.199	0.007	0.055	0.017	0.000	0.000	0.016	0.069	0.000	0.016	1.148	0.032	1.180
2000	0.031	0.648	0.179	0.006	0.046	0.016	0.000	0.000	0.013	0.057	0.000	0.019	1.015	0.031	1.046
2001	0.027	0.575	0.162	0.005	0.040	0.016	0.000	0.000	0.011	0.043	0.000	0.022	0.900	0.030	0.930
2002	0.024	0.513	0.153	0.000	0.035	0.015	0.000	0.000	0.009	0.040	0.000	0.025	0.815	0.028	0.843
2003	0.021	0.451	0.141	0.000	0.030	0.015	0.000	0.000	0.010	0.036	0.000	0.023	0.727	0.027	0.754
2004	0.019	0.401	0.130	0.000	0.026	0.015	0.000	0.000	0.009	0.033	0.000	0.021	0.652	0.026	0.678
2005	0.017	0.350	0.121	0.000	0.022	0.014	0.000	0.000	0.009	0.031	0.000	0.019	0.583	0.024	0.607
2006	0.014	0.297	0.112	0.000	0.019	0.013	0.000	0.000	0.009	0.027	0.000	0.018	0.508	0.023	0.531
2007	0.012	0.252	0.104	0.000	0.016	0.013	0.000	0.000	0.008	0.023	0.000	0.016	0.432	0.022	0.464
2008	0.011	0.221	0.098	0.000	0.014	0.013	0.000	0.000	0.007	0.019	0.000	0.015	0.396	0.020	0.416
2009	0.009	0.198	0.089	0.000	0.007	0.012	0.000	0.000	0.006	0.016	0.000	0.013	0.351	0.019	0.370
2010	0.009	0.181	0.081	0.000	0.000	0.012	0.000	0.000	0.005	0.014	0.000	0.009	0.310	0.018	0.328
2011	0.008	0.166	0.072	0.000	0.000	0.012	0.000	0.000	0.000	0.012	0.000	0.007	0.276	0.017	0.293
2012	0.008	0.157	0.066	0.000	0.000	0.011	0.000	0.000	0.000	0.010	0.000	0.005	0.257	0.016	0.273
2013	0.007	0.146	0.061	0.000	0.000	0.011	0.000	0.000	0.000	0.009	0.000	0.003	0.236	0.014	0.250
2014	0.007	0.137	0.055	0.000	0.000	0.011	0.000	0.000	0.000	0.007	0.000	0.002	0.218	0.013	0.231
2015	0.006	0.126	0.049	0.000	0.000	0.011	0.000	0.000	0.000	0.006	0.000	0.001	0.199	0.013	0.211

REMAINING RESERVES†

	Oil Million bbl			Gas Bcf		
	LOW	RESERVES MID	HIGH	LOW	RESERVES MID	HIGH
NORTH SLOPE						
DEVELOPED						
East Barrow	-	-	-	7	7	7
Endicott	215	280	415	582	782	1,182
Kuparuk River Unit	685	885	1,085	395	520	670
Lisburne reservoir	80	150	350	788	888	988
Milne Point Area	30	50	80	-	-	-
Prudhoe Bay Unit	4,400	4,700	5,400	25,840	25,840	25,840
South Barrow	-	-	-	5	5	-
UNDEVELOPED						
Beaufort Sea	0	150	300	-	-	-
Pt. Thomson/Flaxman Id	0	500	300	0	0	5,000
West Sak	0	500	3,000	-	-	-
Niagak	0	50	80	-	-	-
Point McIntyre	150	200	300	-	-	-
SUBTOTAL	5,560	6,965	11,310	27,617	28,042	33,692
COOK INLET						
PROVEN AND DEVELOPED						
Beaver Creek	-	1	-	-	152	-
Beluga River	-	-	-	-	691	-
Cannery Loop	-	-	-	-	148	-
Granite Point	-	16	-	-	12	-
Ivan River, Lewis River	-	-	-	-	-	-
Pretty Creek, Stump Lake	-	-	-	-	499	-
Kenai	-	-	-	-	572	-
McArthur River	-	40	-	-	589	-
Middle Ground Shoal	-	8	-	-	5	-
North Cook Inlet	-	-	-	-	606	-
Swanson River	-	8	-	-	148	-
Trading Bay	-	1	-	-	30	-
PROVEN BUT UNDEVELOPED OR SHUT-IN						
Birch Hill	-	-	-	-	11	-
Falls Creek	-	-	-	-	13	-
Nicolai Creek	-	-	-	-	3	-
North Fork	-	-	-	-	12	-
Sterling	-	-	-	-	23	-
West Foreland	-	-	-	-	20	-
West Fork	-	-	-	-	6	-
SUBTOTAL	74	74	74	3,619	3,619	3,619
STATE TOTAL	5,634	7,039	11,384	31,236	31,661	37,311

*Medium case oil price scenario †As of 1-1-90.

Source: Alaska Department of Revenue, Alaska Department of Natural Resources Division of Oil & Gas, Alaska Oil & Gas Conservation Commission

Regional Corp. in early December 1991 appealed a court ruling that the companies must furnish well data from the 1 KIC Jago River wildcat, the only well drilled on the ANWR Coastal Plain, to Alaska's Department of Natural Resources.

In November 1991, the Alaska Supreme Court overturned a lower court ruling barring DNR from reviewing data from the well. As the 1992 IPE went to press, ASRC had filed a motion for reconsideration with the state supreme court. If the court declines, Chevron BP planned to seek a stay of the order in order to petition the U.S. Supreme Court to hear the case.

The companies want the well data kept proprietary, and DNR wants to review the data to help it evaluate the area's potential and better plan lease sales on nearby state acreage.

The state court ruling dealt only with the issue of whether DNR could review the data, not the larger issue of whether the data could be made public. If the U.S. Supreme Court takes up the case, expectations were that it would hear it by midyear 1992. If not, the DNR then will be allowed to review the data. However, the companies plan to take legal action to block release of the data to the public if DNR opts to do so.

One irony in the controversy, the new head of DNR is Harold Heinze, former president of ARCO Alaska.

Offshore disappointing

Perhaps almost as keenly disappointing to oil and gas explorationists as the lockup of ANWR has been the lack of success reported to date in Alaska's frontier offshore basins.

Initial seasons in the Chukchi Sea, upon which industry pinned high hopes after the disappointments of the Gulf of Alaska in the 1970s and Bering Sea in the 1980s, yielded no reports of commercial hydrocarbon discoveries.

That disappointment was reflected in the second Chukchi Sea sale, which turned in the worst performance of any major federal sale of frontier acreage in recent memory.

Chukchi Sea Sale 126 netted a paltry \$7.1 million in apparent high bids for 28 tracts that received 30 bids. Only five companies showed up for the sale, exposing about \$7.4 million.

That compares with the first Chukchi Sea sale, which drew a record 653 bids for 351 blocks, more than any other sale outside the Gulf of Mexico. Sale 109 garnered more than \$478 million in apparent high bids out of \$666 million exposed in often spirited bidding. At the time, industry



*ANWR potential production assumes peak production from mean value economic field. State figures reflect 1990 production and include federal offshore. Sources: Alaska Department of Natural Resources Division of Oil & Gas, Oil & Gas Journal Energy Database.

ANWR debate: How much oil and gas is there?

Debate in 1991 over leasing the Coastal Plain of the Arctic National Wildlife Refuge resurrected some of the same arguments that opponents of leasing have used from the beginning.

The notion that implementing "simple" conservation measures involving insulation or energy saving appliances would obviate the need for ANWR oil is dissected by G. Henry M. Schuler, director of energy studies for the Washington-based Center for Strategic and International Studies, in an adjoining commentary.

The other argument, other than environmental concerns, ANWR leasing opponents use is that the region would provide only a minor contribution, about 200 days' supply at current rates of consumption, to the U.S. energy picture. Industry officials have sharply challenged that notion.

'Walloping' ANWR opponents

Sen. Malcolm Wallop (R-Wyo.), ranking minority member of the Senate energy committee and cosponsor with Sen.

Comparing ANWR resource estimates

	Billion bbl					
	In place	Mean Recoverable Cond.	Uncond.	In place	5% chance Recoverable Cond.	Uncond.
USGS	13.8				29.4	
DOE	13.8	7.51	3.45	29.4	16.00	7.35
BLM	13.8	3.57	1.69	29.4	7.60	3.26
AAPG	23.3	15.16	6.97	49.5	32.20	14.77

Bennett Johnston (D-La.) of the 1991 omnibus energy bill, blasted opponents of ANWR leasing after the bill was defeated by filibuster last year.

He criticized the belief of environmentalists and "a cowed Senate" that "a magical conservation silver bullet" will reduce U.S. oil reliance and that the country doesn't have additional domestic oil sources.

No more idiotic concept has gone unchallenged in years than this, because ANWR will provide only 200 days of American oil needs, it is of no help.

government with even tougher standards of their own.

CAA details

Industry is implementing the first of those mandated composition changes, a rule calling for urban areas not in attainment with CAA goals for carbon monoxide levels to use gasoline containing 2.7 wt % oxygenates beginning Nov. 1, 1992, at least 4 months/year (Fig. 2). Total CO compliance is required for all nonattainment areas by 2000.

Specifically, the average oxygen content of all gasoline sold in the nonattainment areas must be not less than 2.7 wt % and each individual gallon of gasoline is required to contain at least 2 wt % oxygen.

But refiner-marketers have had some experience with requirements for higher oxygen levels in gasoline, with seasonal reduced gasoline volatility rules in a number of states and certain urban areas.

Beyond that, refineries, petrochemical plants, and gas processing plants will be forced to spend additional billions of dollars to comply with stationary air emissions provisions of CAA. Those provisions were to take effect Jan. 1, 1992.

CAA also requires EPA to issue a rule within 1 year setting standards for onboard systems to control refueling emissions. Onboard vapor recovery canisters will be required on all passenger vehicles beginning with the fourth year after issuance of standards. Service stations also will be required to install vapor recovery equipment.

In addition, CAA requires tighter tailpipe emissions standards for cars and trucks in phases between 1994 and 1998 and establishes a pilot program in California to promote use of clean fuel vehicle fleets.

Beginning in 1998, fleets of 10 or more vehicles in serious, severe, and extreme ozone nonattainment areas must reduce tailpipe emissions by 80% for cars and 50% for trucks, compared with 1990 levels.

Beginning in 1996, automakers each year must produce 150,000 alternative fuel cars and light trucks for a California pilot program. In 1999 and each year thereafter, 300,000 vehicles are required.

But nothing else approaches the scope of CAA provisions governing reformulated gasoline. CAA calls for reformulated gasoline to be sold in the nine worst ozone nonattainment areas beginning Jan. 1, 1995 (Fig. 3). Ozone nonattainment areas also must reduce volatile organic compounds (VOCs) and air toxics emissions 15% by 1995 and 25% by 2000.

Reformulated gasoline would have levels of VOCs and

Table 1

Costs of key Clean Air act provisions*

Provision	Effective date	Cost to industry
Oxygenated fuels	Nov. 1, 1992	\$670 million/year†
Reformulated gasoline	Jan. 1, 1995	\$32 billion
Low-sulfur diesel	Oct. 1, 1993	\$3.3 billion
Stationary air toxics	Jan. 1, 1992	\$6 billion

*Estimated. †Manufacturing costs.
Source: Ashland Oil Co.

Table 2

Incremental cost to produce reformulated gasoline*

Fuel volume affected	5.8 million b/d
Incremental manufacturing cost	10-15¢/gal
Total annual cost to consumer	\$9-13 billion

*All 96 ozone nonattainment areas.
Source: Ashland Oil Co.

Table 3

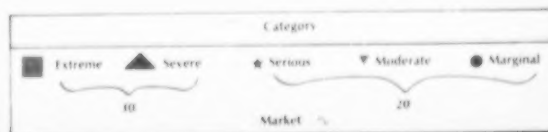
The potential of gas to displace oil

	immediate	1 year 1,000 b/d	5 years	10 years
STATIONARY SOURCES				
Residential	5	20	100	225
Commercial	25	100	190	250
Industrial	50	200	400	600
Power generation	50	100	300	400
Subtotal	130	420	990	1,475
MOBILE SOURCES				
Vehicles	0	0	5	240
Total	130	420	995	1,715

Source: American Gas Association



Nonattainment category: Extreme Los Angeles (CA) (MSA)	
Nonattainment category: Severe	
Baltimore, Md.	St. Louis, Mo.
Chicago, Ill. (incl. Wis.) (MSA)	New York, N.Y.-N.J. Conn. (MSA)
Houston-Galveston-Brazoria, Tex. (MSA)	Philadelphia, Pa.-N.J. (Del.) (MSA)
Minneapolis-Ramsey, Wis. (MSA)	San Diego, Calif.



U.S. oxygenate supply and demand*

Table 5

	Winter 4 mos. b/d	Other 8 mos. b/d	Annual average, b/d
Demand			
Ethanol (MTBE equivalent)	128,000	128,000	128,000
TAME (MTBE equivalent)	12,000	12,000	12,000
MTBE	477,000	383,000	414,000
Total	617,000	523,00	554,000
Supply			
Ethanol (MTBE equivalent)	128,000	128,000	128,000
TAME (MTBE equivalent)	12,000	12,000	12,000
MTBE	230,000	230,000	230,000
Total	370,000	370,000	370,000
Shortfall	247,000	153,000	184,000

*All 96 ozone nonattainment areas
Source: Ashland Oil Inc.

Summer baseline gasoline vs. the Clean Air Act mandate

Table 7

Hydrocarbon type	Baseline gasoline*	CAA mandate†
Aromatics, vol. %	32.0	25.0 maximum
(Benzene)§, vol %	(1.53)	(1.0 maximum)
Olefins, vol %	9.2	—
Saturates, vol %	58.8	—
Oxygen content, wt %—	—	2.0 minimum¶

*EPA will establish winter baseline gasoline specifications. †Will impact approximately 22 vol % U.S. gasoline by Jan. 1, 1995.
§Benzene is part of the total aromatics. ¶Approximately 11 vol % MTBE.

Source: George Unzelman, HyOx Inc., after others.

Alternative oxygenate candidates for gasoline

Table 9

	Boiling point, °F.	(R + M)/2 octane
Alcohols		
Isopropyl	180	108.5
n-Propyl	207	104
Isobutyl	225	—
n-Butyl	244	87
Ethers		
Diisopropyl	154	104.5
Methyl t-hexyl	—	89
Methyl phenyl	309	110
Ethyl t-amyl*	212	—
Isopropyl t-butyl	—	100.5
Esters		
Methyl acetate	135	105
Ethyl acetate	171	105
Isopropyl acetate	199	102

*TAME
Source: George Unzelman, HyOx Inc., after others.

balance demand with expected supply of oxygenates in CO nonattainment areas for winter 1992-93.

Refinery planners will have to cope with more than just

Octane and oxygen values for oxygenates

Table 6

Ethers	Blending octane*			Oxygen, wt %
	RON	MON	(R + M)/2	
MTBE	118	100	109.0	18.2
ETBE	118	102	110.0	15.7
TAME	111	98	104.5	15.7
Alcohols				
Methanol	133	99	116.0	49.9
Ethanol	130	96	113.0	34.7
TBA	109	93	101.0	21.6

*All blend values are estimates from average data and vary with hydrocarbon type of gasoline and concentration of oxygenate.
Source: George Unzelman, HyOx Inc., after others.

Physical properties of oxygenates

Table 8

Ethers	Gravities*		Boiling point, °F.	Rvp, psi	
	sp.gr	API		Actual	Blend
MTBE	0.744	58	131	7.8	8-10
ETBE†	0.747	58	161	1.5	3-5
TAME	0.770	52	187	1.5	3-5
Alcohols					
Methanol§	0.796	46	149	4.6	50-60
Ethanol†	0.794	46	172	2.3	17-22
TBA	0.791	47	181	1.8	10-15

*API gravities are to the nearest degree. †Currently, MTBE and ethanol are the only oxygenates being used in U.S. gasoline in significant quantities. §Methanol must be used with an appropriate cosolvent per EPA waivers.

Source: George Unzelman, HyOx Inc., after others.

How gas processing plant permit costs will jump

Table 10

	Current TACB permit fees*	Title V permit fees*
Initial permit	\$10,000	\$ 127,103
Annual permit	..none..	\$ 127,103
Permit renewal (after 15 years)	\$10,000	\$ 127,103
Total cost over 15 years	\$20,000	\$2,033,848

*The listed fees do not include any potential inspection fee which may be levied by the air control authority.
Source: ENSR Consulting & Engineering

reformulated fuels in CAA implementation. Similar problems will be incurred in CAA provisions covering hazardous air pollutants (HAPs) (Fig. 6, Table 11) and state implementation plans (SIPs) (Fig. 7).

Gas processing outlook

One clear winner in the CAA debate is the U.S. gas processing industry.

According to Purvin & Gertz Inc., Dallas, the effects of CAA and other clean air legislation will sustain future gas

Table 1

A grading of East Bloc investment attractiveness*

	Soviet Union	Bulgaria	Czechoslovakia	Hungary	Poland	Romania	Yugoslavia
Overall	D+	D	B	B-	C+	D	C
Economic	C-	C-	B+	B-	C+	C-	C-
State of the economy	D	C-	A-	B-	C+	D-	D
Reform prospects	C	C+	A-	A-	B+	C	C+
Debt burden	B	D	A-	D	C	A-	B-
Inflation	D	C-	B-	C	D	C	D
Access to EC market	C	C	B	B	B	C	B
Labor market	C-	C-	A-	B	C	D	C
Education/labor skills	C	C-	A	A	B-	D	C
Work ethic/discipline	D	C-	B	B-	C-	D	C
Market size	A	F	C	D	B	B-	B-
Natural resource endowment	A	F	D	F	B	C	C
Receptivity to foreign investment	C	C	A-	A	B-	D	B
Prospects for profit repatriation	C-	D+	B	A	A	D	A
Foreign aid prospects	D+	D	C-	B-	B	D-	B-
Political prospects	D	D+	A-	B+	B-	D-	D
Strength of non-Communist parties	C-	D	B	A	B	D	B
Political stability	D-	C	A	B	C	D-	F
Democratic tradition	F	D	A	B-	C	D-	C-

*A = outstanding; F = dismal.

Source: PlanEcon

newly emerging democracies that environmental considerations be given a high priority in energy choices.

Movit said it's essential to understand the nature of the political and economic dilemma that forced rapid change in eastern Europe in order to identify near term tasks as well as predicting the kinds of changes ahead in those economies and especially in their energy sectors.

The Communist political regimes, which had held sway for decades in eastern Europe, had made an implicit social contract with the populace. Movit wrote in the June 3, 1991 Oil & Gas Journal. In return for a monopoly on political power, the party promised steady improvements in the living standard of the workers.

By the late 1980s, however, it had become obvious that Stalinist economics was a failure, and instead of providing improvements in the standard of living, the already big gap between East and West was widening. That eventually led to the demise of the ruling party throughout the eastern European nations.

Movit notes that while the successor regimes want to return their countries to economic growth, they are not convinced the only way this can be accomplished is through improved efficiencies inherent in the resurrection of the private sector.

Central authority involvement disappearing

With economic reforms planned or under way in Czechoslovakia, Poland, Hungary, Romania and Bulgaria, the bureaucratic links that ensured daily involvement by the central government in production activity are disappearing.

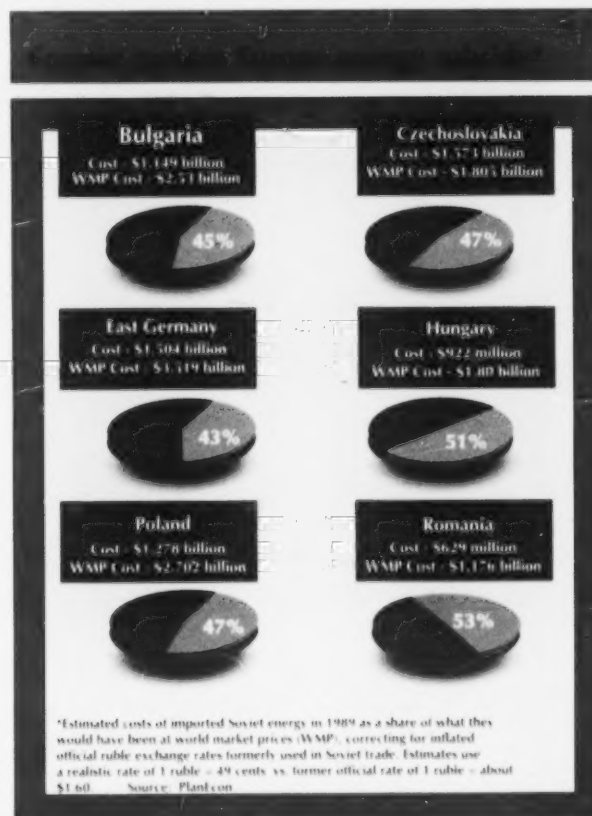
The regimes are seeking to rationalize their economies by liberalizing the process of price formation, liberalizing trade, and ending the subsidization of inefficient enterprises. Movit wrote:

In order to mobilize the power of the profit motive, large state enterprises are being converted to joint stock companies, and the formation of new small and medium sized enterprises is being encouraged.

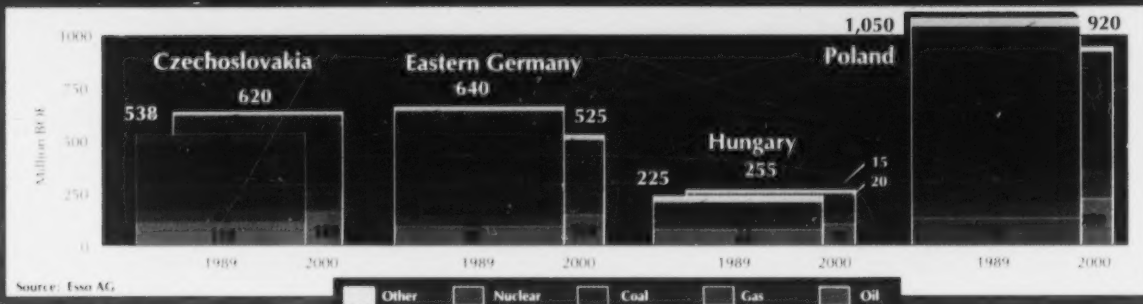
Although these changes will be very positive in the long term, they spell a big drop in economic output and economic austerity in the near term. The extent of such a

downturn will depend on each country's respective health at the beginning of economic transformation and how efficiently change is implemented.

Movit contends the economic pain eastern Europe is undergoing stems from irresponsible behavior by the former regimes in an effort to protect living standards and



OPPORTUNITIES IN EASTERN EUROPE



thus sustain the rationale for the existence of the Communist system.

This irresponsible management generally involved:

- Monetary overhang: Communist leaders sought to keep prices of staple goods for the workers very low and to prevent inefficient firms from failing to avoid the social

costs of unemployment. This was accomplished by an elaborate system of huge state subsidies resulting in chronic state budget deficits financed by printing money. Serious disequilibrium in consumer goods markets resulted, eroding incentives to labor.

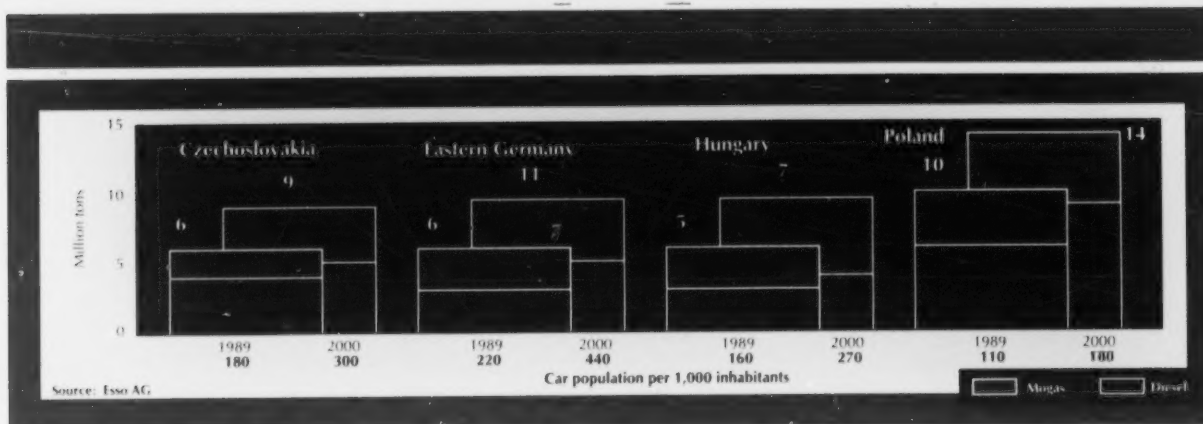
- External debt: A number of these countries sought to

East European oil, gas trade*

Table 2

	Crude oil — 1,000 metric tons —	Refined products — 1,000 metric tons —	Natural gas million cu m		Crude oil — 1,000 metric tons —	Refined products — 1,000 metric tons —	Natural gas million cu m
PRODUCTION				1990	89,873	7,728	54,739
1985	17,348	112,801	58,852	1Q	22,321	1,700	14,170
1986	16,708	116,936	58,372	2Q	24,154	1,705	13,201
1987	15,902	119,839	57,024	3Q	20,696	2,133	12,919
1988	15,438	120,112	55,363	4Q	22,702	2,190	14,449
1989	14,979	120,135	50,404	...of which, from the U.S.S.R.			
1Q	3,717	29,619	14,241	1985	73,360	7,372	36,780
2Q	3,796	30,196	11,577	1986	80,597	7,418	41,283
3Q	3,812	30,574	11,012	1987	80,599	7,843	43,709
4Q	3,654	29,746	13,274	1988	78,107	7,763	45,198
1990	13,494	104,124	42,323	1989	78,545	7,573	52,039
1Q	3,452	27,626	12,456	1Q	18,219	1,584	13,222
2Q	3,424	26,234	9,528	2Q	20,887	2,518	13,859
3Q	3,394	24,243	9,265	3Q	20,132	1,191	12,325
4Q	3,224	26,021	11,074	4Q	19,307	2,280	13,633
EXPORTS				1990	61,438	7,314	52,483
1985	874	22,262	776	1Q	16,033	1,461	13,972
1986	1,068	23,011	790	2Q	16,320	1,643	12,846
1987	730	23,685	1,014	3Q	13,425	1,822	11,984
1988	500	25,069	979	4Q	13,660	2,388	13,681
1989	930	27,201	2,096	Apparent consumption			
1Q	230	6,666	522	1985	113,522	100,600	96,508
2Q	230	7,050	523	1986	118,336	103,345	100,475
3Q	230	7,233	525	1987	120,678	105,015	101,473
4Q	240	6,252	526	1988	120,459	103,535	100,713
1990	750	19,819	2,104	1989	120,425	101,212	102,321
1Q	180	5,379	523	1Q	28,696	24,831	27,419
2Q	190	5,106	525	2Q	30,711	25,544	24,450
3Q	190	4,726	528	3Q	30,551	25,306	23,316
4Q	190	4,608	528	4Q	30,467	25,531	26,836
IMPORTS...				1990	102,617	92,033	94,958
1985	97,021	10,061	38,432	1Q	25,593	23,947	26,103
1986	102,696	9,420	42,893	2Q	27,388	22,833	22,204
1987	105,508	8,861	45,463	3Q	23,900	21,650	21,656
1988	105,521	8,492	46,329	4Q	25,736	23,603	24,995
1989	106,376	8,278	54,013	*Eastern Europe includes Bulgaria, Czechoslovakia, eastern Germany, Hungary, Poland, Romania, and Yugoslavia. †Figures for fourth quarter 1989 are estimates.			
1Q	25,209	1,878	13,700	Source: PlanEcon			
2Q	27,145	2,398	13,396				
3Q	26,969	1,965	12,829				
4Q	27,053	2,037	14,088				

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borrow in the West to prop up consumption, resulting in heavy per capita debt burdens. Last year, Bulgaria was forced to declare a moratorium on debt repayment and is not on the road to full rescheduling. This has resulted in decreased access to western credit markets across the board for eastern European borrowers.

The exception is Czechoslovakia, where extremely conservative borrowing policies prevented any buildup of western debt.

• Disinvestment in the domestic economy. To further protect consumption, the burden of macroeconomic adjustment, such as that required by the contraction of available western credits in the early 1980s, was, to the degree possible, shifted to investment.

Thus debts were incurred with respect to domestic productive capital stock, with respect to much needed infrastructure, both social and economic, and with respect to the environment.

Movit says the new regimes in eastern Europe face the task of transforming the region's inefficient, outdated industrial infrastructure, an effort that calls for closing some enterprises and eliminating redundant jobs.

At the same time, those regimes must seek to stabilize economies by restoring balance in consumer goods markets, cope with heavy debt burdens, and start to reverse damage to infrastructure, productive base and environment caused by decades of mismanagement and neglect.

Western investment needed

Eastern Europe's challenge can be made more manageable with an influx of western aid and investment that brings modern technology and resources to renovate capital stock and boost export competitiveness.

That means opportunities for western energy firms that can overlook the bleak near term economic outlook for eastern Europe's transition period and see the prospect of gaining a foothold in a large, almost untapped market with low wage costs, a relatively educated labor force, and attractive location.

Although investments have been small to date, "pioneering western firms are finding that bringing in a western management team can make a good deal of difference in an eastern European firm's profitability fairly rapidly," Movit wrote.

He uses a range of criteria to rank former Soviet satellites in eastern Europe for investment attractiveness, comparing them to the former U.S.S.R. (Table 1), noting their relative attractiveness hinges on a number of factors related to the legal environment as well as the outlook for political stability and return to strong economic growth.

Overall, Czechoslovakia, Hungary and Poland fare best under the PlanEcon preliminary ranking, which was assembled prior to the full outbreak of civil war in Yugoslavia in

1991.

Aggravating factors seen

Movit cites three factors aggravating the slowdown of economic transition and stabilization in eastern Europe and affect traditional export markets and trade terms.

The first factor involves the trade shock stemming from the dismantling of the Comecon trading system. The former Soviet satellites mainly have exported manufactured goods to the U.S.S.R. in exchange for Soviet exports of energy and other key raw materials (Table 2).

Soviet energy imports were paid for in nonconvertible rubles at special intra-Comecon prices.

The price formula entailed a 5 year moving average of world market prices. If the price of oil to eastern Europe were converted to dollars at the official Soviet exchange rate in 1989, East Europeans would have been paying more than \$24/bbl for crude. However, because East European exports that paid for the oil were grossly overpriced in intra-Comecon trade, the real dollar value paid for Soviet oil was much lower.

Using a cross exchange rate of the ruble vs. the dollar based on costs in an eastern European economy of earning \$1 and 1 ruble in foreign exchange through trade, that rate would have been about 1 ruble = 50¢ compared with the official Soviet exchange rate \$1.60/1 ruble. Under this formula, the real price eastern Europe paid for Soviet oil was an average of less than \$7.50/bbl, according to PlanEcon. That illustrates the huge energy subsidy Soviet oil provided those countries (Fig. 2).

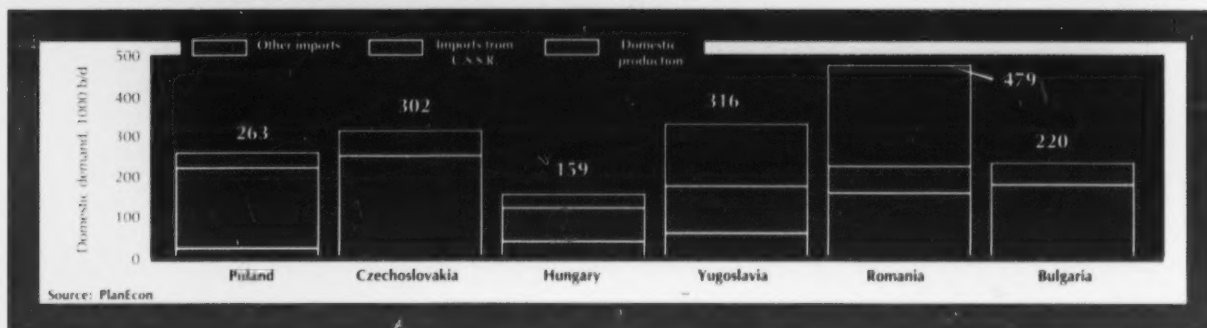
All that changed in 1991, with the Soviets requiring eastern Europe to pay world market prices for Soviet oil with bilateral trade to be settled in hard currency. In addition to the big shift in terms of trade in favor to the Soviets, the change created severe balance of payments pressure on the eastern European economies at the worst possible time.

Prior to the disintegration of the Soviet Union at yearend 1991, the Soviets had reached agreements with East European trade partners to help ease the effects of transition. With Hungary and Czechoslovakia, ruble surpluses accumulated in bilateral trade with the U.S.S.R. in the past were to be converted to dollar debt of the U.S.S.R. and used to offset some of the expected deficits in the future.

"Given the very sharp shift in their terms of trade, however, the new assets are going to be rapidly used up. In fact, the pace at which these assets can be drawn down to settle bilateral trade accounts is a current point of disagreement," Movit wrote.

Whether the agreement will be maintained with the Russian federation, the Soviet Union's successor as primary oil supplier to East Europe, remains to be seen.

The East Europeans believe they can make substantial



progress in several years and are anxious to use all of the assets the next 2 years to cushion the shock to domestic economies in transition to a market oriented economy. The former Soviet Union had preferred the assets be used over a longer period to offset bilateral trade deficits and was not in any shape to postpone prospective gains from the trade shift—even before the economy went into a complete tailspin that triggered the August coup and Communist Party downfall in second half 1991.

With Russian President Boris Yeltsin's recent, extremely risky market reforms, that is more so the case in 1992.

And, says Movit, added negative economic effects on any eastern European economy affects its neighbors, because these nations remain each others' major trading partners, contributing to a possible continuing downward spiral.

Energy aspects

These economic and trade developments suggest often mutually offsetting implications for eastern Europe's energy sector.

Movit contends two things will mitigate the likely slide in domestic energy production accompanying economic dislocation in eastern Europe and the loss of affordable Soviet energy:

- The economic downturn will also mean a reduction in the quantity of energy consumed, although less than in proportion to the downturn in economic output.

- The transformation to a market economy will mean improved energy efficiencies by introducing higher relative prices for energy that will spur direct and indirect conservation measures.

Movit also sees the introduction of market principles spurring a shift from energy intensive heavy industrial production to light industrial goods and services and the pursuit of profit rather than just maximizing output. Under the Stalinist model, industry's share of energy consumption is very high compared with the international average. That should decline with the shift of economies to light industry, transport, services, and housing.

At the same time, expansion of truck and auto fleets in eastern European countries will boost demand for motor fuels.

However, the net effect, contends Movit, is a certain reduction in the energy intensity of economic output in eastern Europe.

Environmental considerations

The newly emerging environmental consciousness in eastern Europe will complicate eastern Europe's efforts to mitigate its energy shortfall.

Movit points to the region's heavy reliance on very low quality, high sulfur lignite to generate electric power. PlanEcon estimates low quality coal (mostly high sulfur

lignite) accounted for more than half the primary energy production in Bulgaria, Czechoslovakia, eastern Germany, and Yugoslavia in 1990.

Eastern European concerns about poor air quality and damage from acid rain caused by extensive burning of lignite are reinforced by western Europe's position that the environmental problem is shared.

Despite environmental and safety concerns about nuclear power, says Movit, most East European nations can't afford to abandon nuclear power programs because of their limited fossil fuel resources, notably hydrocarbons. Work will focus on assuring safe operation of existing plants with expansions postponed until improved safety designs, such as those used by the Finns in their Soviet designed reactors, can be incorporated.

The former Soviet Union's role

The opening of energy markets in the former Soviet Union is a critical development for eastern Europe.

With the successor republics accelerating the pace of western investment in the former Soviet energy sector and trade between those republics and eastern Europe settled at world market prices and in hard currency, there is no longer an incentive for eastern Europe to take Soviet energy other than the existence of an infrastructure. And eastern Europeans are seeking to diversify energy supply sources in light of the severe cuts in Soviet oil deliveries they experienced in 1991.

"In the longer run, eastern Europe will be viewed as just one part of an expanded European energy market," Movit wrote.

"Nonetheless, for a variety of reasons, including historical and geographic, it is likely that the Soviet Union will continue to play a significant role as energy supplier in the region.

"The major question in regard to how significant that role might be is the likelihood that western energy firms will become involved in energy production in the Soviet Union—which could help to stem the decline in Soviet energy production—and thus support a higher level of net energy exports."

Best market prospects

Esso's Kohlmoegen sees the former East Germany, Poland, Czechoslovakia, and Hungary as the eastern European nations offering the markets most likely to be developed in the near future.

He cites in particular the former East Germany because it was the most advanced member of the former Soviet bloc in industrial development.

Eastern Germany and Poland are already making progress in energy efficiencies with shutdowns of inefficient

and highly polluting industrial complexes and the implementation of their first energy conservation measures.

Esso predicts total energy demand in Poland and eastern Germany will fall despite a growth rate in gross domestic product of an average 5%/year in the second half of the decade (Fig. 3).

In first half 1991, eastern Germany's energy consumption fell 28% from the year before.

Esso also sees the energy mix in eastern Europe changing, reflecting the changes in western Europe during the 1960s and 1970s when oil and gas gained at the expense of coal and lignite.

A key component of increased oil demand will be expected sharp growth in motor gasoline and diesel fuel when improved standards of living spur increased purchases of private vehicles (Fig. 4).

As the economies grow that will spur demand for commercial transportation and in turn increase demand for bitumen for road construction and lube sales for the growing vehicle fleets.

"This development is in widening contrast to the existing thin retail station networks operated by state monopolies under the principle: no service, no shops, and no spare parts from badly maintained installations. They are located off the main roads to provide space for the lines of waiting customers," Kohlmorgen said.

Supply infrastructure

The four major eastern European economies have remained heavily dependent on access to oil fields in the Soviet Union since World War II via the Friendship Pipeline system (Fig. 5).

All four have more than sufficient refining capacity, in some cases allowing for exports of products.

As environmental pressures reduce use of coal, demand for heating oil is expected to rise sharply in the years to come, notably in eastern Germany (Fig. 6).

Imports of non-Russian crudes by Hungary and Czechoslovakia are possible via pipelines from the terminal at Rijeka, Yugoslavia, and to Poland via the harbor at Gdansk, Kohlmorgen notes (see Fig. 1). However, physical limitations throughout the region make access to western terminals a priority.

Eastern European refineries will require major modernization and upgrading to match a lighter demand barrel and at the same time meet stricter western standards for environmental protection.

Whether state owned refineries attract foreign equity or whether processing exchange and/or offtake arrangements will be more likely is less important, Kohlmorgen contends.

Oil demand will grow, and existing processing capacity will be needed if it can be made efficient and environmentally acceptable," Kohlmorgen said.

But governments that retain unprofitable refineries by subsidies or protectionist regulations will make a severe mistake.

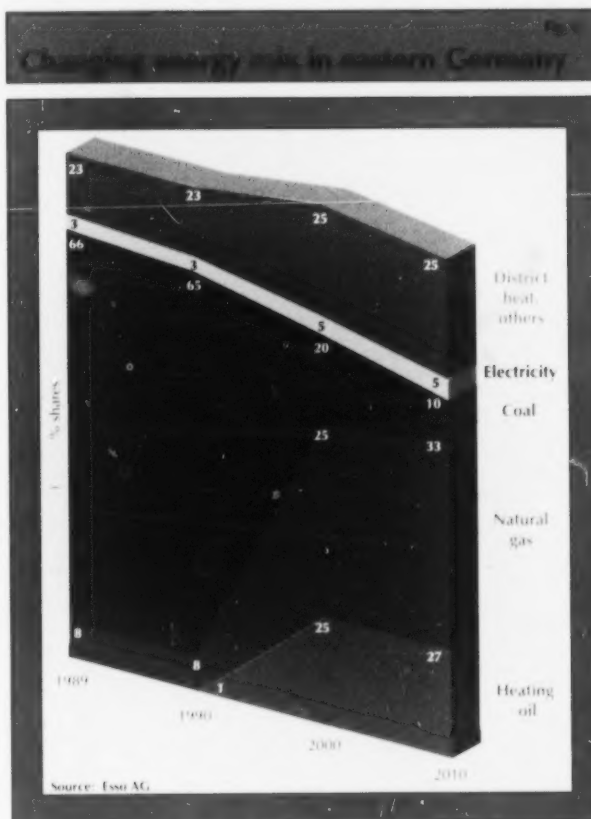
Investment decisions

Deciding whether or not to enter an eastern European market will prove a major decision for any oil company.

In the majority of cases, the market entrances will require joint ventures with local and this means in most cases, state owned companies—monopolistic suppliers of products," Kohlmorgen said.

This often offers a solution for the fact that purchase of land is not yet permitted or very restricted for foreigners. Protection of investment, free profit distribution in hard currency, operating management, and other issues of vital importance for an investor frequently call for individual agreements with governments and/or partners.

But we expect that the general investment environment will improve steadily because it is in the interest of the



governments to attract foreign capital and know-how.

He cites Czechoslovakia, which in late 1991 suspended regulations demanding a joint venture with a local partner for every foreign investment.

Similar rules in Poland and Hungary are expected to fall by the wayside.

Such joint ventures pose challenges to both partners, Kohlmorgen notes.

The local partner must accept the technical and managerial know-how of the foreign company, share or even hand over the operational responsibility, and at the same time give up the security of a monopolistic seller who never had a reason to consider efficiency, costs, and customer relations.

The foreign partner, on the other hand, must not only develop the business, but he must be highly sensitive with regard to the feelings not only of his local partners but also of politicians, authorities, media, and not to forget customers.

Although irreversibly moving towards a market economy system, the legal system, the tax system, administration, the attitude toward work and decisionmaking, the permitting process, and a lot more, are still largely influenced by the old system.

I am confident that by the end of this decade the eastern European countries will have completed the transformation process from the Communist centrally planned economy to the market economy system.

Part of this process will be the development of an oil market very similar to the one operating in western Europe. Most major oil companies and probably others will participate in this competition.

This development will contribute to a better standard of living for people in eastern Europe—but it means also sound business opportunities for western oil companies.

U.S. companies."

He said there are signs of improved trade with the Soviet Union in the petroleum equipment sector.

U.S. direct exports of oil field machinery to the Soviet Union totaled \$18 million in the first quarter of 1991 and could reach more than \$70 million for the year. This compares with a total of \$26 million in 1989 and only \$1.8 million in 1990.

To put these exports to the Soviet Union in perspective, total U.S. exports of petroleum equipment in 1990 were \$2.6 billion, of which the largest volume of exports went to Venezuela, worth about \$300 million.

Investment climate

Exports of U.S. oil equipment and services to Russia were never high, but plummeted after President Jimmy Carter imposed foreign policy controls on oil and gas equipment exports to the Soviet Union in 1978 to protest human rights abuses. The controls were toughened in each of the next 3 years.

Moore notes "These unilateral foreign policy export controls disadvantaged American businesses. By 1983 the U.S. share of the Soviet petroleum equipment and services market had dropped to four tenths of one percent. Our European allies, Japan, and Canada stepped in to supply the equipment and services U.S. companies were barred from providing.

The Commerce Department estimates that, had U.S. manufacturers continued to maintain their traditional share of the Soviet market, they would have received about \$2 billion in orders during the 1979-85 period, instead they actually received \$170 million.

This loss of \$1.83 billion cost individual American energy firms, and it cost the U.S. economy, almost 46,000 jobs, based on Commerce's standard formula that each \$1 billion in exports represents 25,000 jobs."

Moore said DOE has developed a list of petroleum technology and equipment the Soviets need, and all the possible sources of supply.

Virtually without exception, the U.S. could meet every Soviet need with state-of-the-art equipment and technology, but so could other suppliers, with at least adequate or high quality technology and equipment."

Bilateral talks

An Energy Department workshop in 1991 brought Soviet energy officials and American oil company executives into more discussions on joint ventures.

Goal of the U.S. seminar was to establish a framework for technology cooperation, and expand commercial opportunities between U.S. firms and Soviet officials.

Rantik Margulov, first deputy chairman of the state fuel and energy commission of the U.S.S.R. Cabinet of Ministers, headed the Soviet delegation, which included representatives of the fuel and energy industries, and delegates of several major fuel producing republics.

At the end of the seminar, U.S. and Soviet officials agreed to continue to hold periodic consultations on energy policies and directions, and on world energy issues.

They also agreed DOE and private oil firms would exchange technology with the Soviet central and republic governments and energy entities.

The two countries will exchange information on the development of their respective national energy strategies and will work to establish a working group to compare energy data, analytical methods, research and policy recommendations, and approaches to environmental problems.

The two countries will develop a program to exchange and assess data on oil and gas technologies, and to share

Past and projected Soviet oil production

	Million b/d	% change/year
1980.....	12.0	NA
1981.....	12.2	1.7
1982.....	12.2	0
1983.....	12.3	0.8
1984.....	12.2	-0.8
1985.....	11.9	-5.7
1986.....	12.3	3.4
1987.....	12.5	1.6
1988.....	12.5	0
1989.....	12.2	-2.4
1990.....	11.4	-6.6
1991.....	10.5	-7.9
1992.....	9.6	-8.6
1993.....	9.2	-4.2
1994.....	9.1	-1.1

Source: General Accounting Office from PlanEcon data

scientific studies. That program may include personnel exchanges between government laboratories and private companies in both nations.

Moore explained U.S. companies seeking business in the Soviet Union are having problems determining whether to negotiate with the central or local governments, face tax policy problems, and need more protection for their "intellectual properties."

Moore said "When these are solved, you will find companies ready to move very quickly."

U.S. officials said American companies were interested in obtaining Soviet downhole turbine drilling, enhanced oil recovery, and steamflooding technology.

Joint ventures

Yuri V. Dubinin, Soviet Ambassador to the U.S., predicted political changes in the Soviet system will "lay the foundation for a new mode of economic development" which will enable the Soviets to compete in world markets.

He said Russian leaders would like to "go as fast as possible to a market economy, but a transition period is needed."

He admitted the development of joint ventures has been slowed, partly due to "the absence of a business environment conducive to foreign investments."

Dubinin added, "We see the problem, we are trying to solve it, and we are open to any suggestions."

"Joint ventures will have to face new economic situations if market forces come to play a greater role in the U.S.S.R. or if economic decentralization in the country results in autonomy for the Soviet Republics."

He noted American and Soviet joint venture partners often are working at cross purposes.

"American firms want access to the Soviet Union while the goal of the Soviet laws is to attract foreign capital, equipment, technology, and management skills, and expand Soviet exports."

Barriers seen

Both the Soviet and American governments must remove barriers if commercial trade is to grow.

A new Soviet-U.S. trade agreement and bilateral talks on investment rules, tax systems, and export controls will establish the framework and climate for future U.S.-Soviet business relations.

Frank Kitteridge, president of the National Foreign Trade

Soviet crude and product exports

	Total net exports (Million b/d)	Annual % change	Net crude exports (Million b/d)	Annual % change	Net refined product exports (Million b/d)	Annual % change
1985	3.05	NA	2.09	NA	0.95	NA
1986	3.39	11.35	2.30	9.75	1.10	14.87
1987	3.59	5.85	2.45	6.71	1.14	4.05
1988	3.66	1.85	2.48	1.14	1.18	3.38
1989	3.39	- 7.31	2.28	- 8.08	1.11	- 5.69
1990	3.21	- 5.29	2.23	- 2.10	0.98	- 11.82
1988-90	-12.21		-10.01	-16.84		

Source: General Accounting Office from PlanEcon data

Council Inc., said "From the U.S. point of view, these agreements are critical because competition for access to Soviet markets is intense, and our major trade competitors are considerably ahead of us."

Kitteridge said granting of most favored nation status for the Soviet Union "is extremely important from a symbolic point of view, and for putting U.S.-Soviet trade on a proper foundation for growth and development."

He added "Such major concerns as the inadequate availability of hard currency and the inconvertibility of the ruble present major obstacles to trade development for both sides."

"The process of accreditation for U.S. businesses in the U.S.S.R. needs to be addressed, as does the critical need for a broader Soviet economic statistical base on which to base financial and investment decisions."

"Immigration, visa, and travel controls on both sides must be significantly relaxed for the pace of business to accelerate, and import licensing procedures, banking practices, and communication facilities all must be addressed in this new trade agreement."

Kitteridge said a bilateral investment treaty is needed to permit repatriation of profits, and the current U.S.-Soviet income tax treaty is outdated.

"For example, the treaty is silent as to the 20% dividend withholding tax imposed by the Soviets on distributions to foreign investors, whereas the recent Soviet treaties with the United Kingdom and other countries completely eliminate this withholding tax."

He added the U.S.S.R. does not yet have corporation law, bankruptcy and antitrust laws, or comprehensive investment law.

More barriers

In a report to the U.S. Congress, the General Accounting Office found lingering Cold-War policies of both governments are hindering American oil companies from helping improve Russian production.

It said Soviet oil production is dropping because the country lacks the capital to finance exploration and production and maintain older equipment.

"This lack of capital results from cutbacks in government funding, uneconomical pricing of oil products, and escalating exploration and production costs."

The study also said the Russians are using outdated and inefficient turbo drilling methods, which require frequent bit changes, to drill about two thirds of their wells. It said they use waterflooding for primary recovery, and most of their oil exploration technology and equipment is obsolete.

GAO notes Soviet officials have said if Russia is to maintain 1990 production levels, it will have to double drilling over the next 5 years and build new pipelines.

A number of problems impede U.S. trade and investment in Soviet oil exploration and production. U.S. oil

companies and petroleum equipment suppliers assert that two 1974 congressional restrictions—the Byrd amendment to the Trade Act of 1974 and the Stevenson amendment to the Export-Import Bank Act of 1945—limit U.S. ability to provide competitive export credit guarantees and insurance.

"These amendments were enacted when the Congress was concerned about granting credit guarantees and insurance involving foreign production of energy while the U.S. needed capital to develop energy at home. In addition, the Congress was concerned about subsidizing energy

trade with the Soviet Union and about Soviet policies for emigration and its military forces in Europe."

GAO said the amendments prohibit U.S. Export-Import Bank loans and financial guarantees for the purchase, lease, or procurement of any product or service used to produce fossil fuel energy resources.

They also limit export credit guarantees and insurance for energy research and exploration projects to \$40 million, and set a \$300 million ceiling on the amount of financing ExIm Bank can support with credit guarantees and insurance.

GAO said if Congress repeals the Stevenson and Byrd legislative barriers it "would not mean immediate U.S. loans and guarantees to the Soviet energy sector" and "ExIm Bank would still apply its standard procedures for assessing the risk of nonpayment of loans."

It said another major impediment to trade and investment is the Soviet unfamiliarity with basic western business practices and management skills.

GAO said the existing U.S.-Soviet tax treaty, which is being renegotiated, lacks profit repatriation and foreign income tax credit provisions.

U.S. policy shift

The Bush administration has taken several steps to remove the barriers to trade on the American side.

In mid-1991 it asked Congress to approve most favored nation trade status for the Soviet Union, which would allow the lowest possible tariffs on imports to the U.S.

The administration also planned to ask for the same status for the newly independent Baltic republics of Latvia, Lithuania, and Estonia.

Most favored nation status would have little effect on American exports to the Soviet Union, which is short of internationally traded currencies.

Soviet exports were \$11 billion to the U.S. in 1990, and might rise by \$400 million a year. Administration officials explained most imports from the Soviet Union are raw materials, which have very small tariffs.

The administration also was asking Congress to ratify a U.S.-Soviet trade agreement signed in 1990.

And it waived the Jackson-Vanik amendment, a 1974 law that restricts U.S. economic cooperation with countries that block free emigration of their citizens. That makes the Soviets eligible for export credit guarantees for agricultural goods and financing from ExIm Bank and the Overseas Private Investment Corp.

Union Treaty

The most positive step the Soviets took to improve trade was the central government's signing an all-union treaty with the republics—although the threat of an all-union treaty had prompted the abortive Aug. 19 coup.

In October, eight of the 12 republics signed the agreement to create a free market community to replace the old regulated economy. More may sign later.

The accord lays the groundwork for further negotiations on up to 20 separate treaties detailing free market relationships, including ones defining the responsibilities and authorities of central and republic governments, establishing ownership rights, setting tax structures, and writing rules governing the management of the energy industries.

The treaty will place control of resources more directly in the hands of the republics, and smooth the way for joint oil and gas ventures with foreign companies.

That in turn would help resuscitate the ailing Soviet oil industry with an infusion of hard currency and technology, and ultimately restore plummeting oil production and exports.

Edward Gendelman, president of Wavetech Geophysical Inc., Denver, said the failure of the 2-day coup will prove a boon for foreign oil ventures because it "maintained the constitutional government and in one shot took care of key hard liners. Reform will move much faster now."

Wavetech has a joint venture with the Ministry of Geology to provide geophysical and geological data on areas in the Turkmen republic.

He said the coup's failure demonstrates to foreign companies that change in the Soviet Union is irreversible, and has enabled more Soviet reformers to assume key positions.

Other

Soviet actions

Hans Jochum Horn, managing partner for Arthur Andersen operations in the U.S.S.R., said the Soviet republics have basically taken over oil and gas operations from the central government and are working to create the stable legal and economic framework needed to attract foreign investments.

The Russian republic, which has 90% of most oil and gas reserves, has been working with the University of Houston on drafting model petroleum legislation which would provide a stable legal and economic framework for foreign venture partners. An initial draft was due early 1992.

The draft code is expected to become the basis for rewriting the country's oil and gas law.

George Hardy, director of the project for the university, said the draft also may become the model for legislation in other Soviet republics.

The law is expected to redefine contractual relationships covering joint ventures, concessions, licenses, and other exploration and production agreements between the Russian republic and foreign companies.

Among other topics, the draft legislation will cover oil and gas conservation, environmental protection, taxes and economic rules, oil and gas pipeline regulation, and technology transfer.

Hardy said Russians working on the project have voiced concern on how to let oil and gas prices rise to market levels and the effect on the domestic economy, whether to form a national oil company, how to privatize the existing oil and gas industry without allowing the existing state monopolies to become private monopolies, and how to assure free trade and competition among the republic's provinces.

Political risk

Despite the progress on both sides, much political risk remains.

Ronald Benson, vice president of Phibro Energy Inc. and director of the White Nights joint venture, said "For American companies to put their capital into Russia there has to be some sort of stability, especially for the oil and gas industry, which requires so much capital."

Our biggest concern is the political situation in the

Soviet capital investment in oil production

	Amount (Billion rubles)	Annual % change
1982	9.6	NA
1983	10.0	4.2
1984	10.3	3.0
1985	11.5	11.7
1986	12.9	12.2
1987	14.6	13.2
1988	15.3	4.8
1989	15.5	1.3
1990*	14.8	-4.5

*Estimated.

Source: General Accounting Office

Soviet Union. You couldn't go to a bank anywhere in the world and get money to do a project like this today in the Soviet Union. You've got to take a risk."

But the Petroleum Industry Research Foundation Inc., in a report on investing in the Soviet Union, said "Although the unstable political environment is likely holding back considerable western investment, operating in an unstable political environment is not uncommon for U.S. oil companies. Instability in the political environment is compounded by a lack of understanding on the part of the Soviets regarding what represents an acceptable business arrangement."

"Different needs must be met, i.e., environmental, local, and financial concerns, new technology—often all among different agencies—before a deal can be concluded. Furthermore, it remains unclear where the starting and ending points are for a successful cooperative venture."

The future

Much remains to be done before foreign oil ventures really blossom in the Soviet Union, and then there is a limit on what they can achieve.

Salomon said "Even if the Soviets had the funds to remount an aggressive exploration and development campaign, we doubt that they could reverse the downward slide of the country's crude oil production."

"Current water cuts and depletion rates seem too high for such a turnaround. The Soviets must start anew with fresh exploration prospects, better-paced development, more effective equipment and new ideas about managing the country's energy resources, as well as its energy consumption pattern. All of this will require capital."

"The western oil firms, which can provide the investment capital, as well as the technology and management skills necessary for such a shift, are the best source—in truth, the only source—of these funds. Thus far, the Soviet politburo has given a lukewarm welcome to western investments in the petroleum sector. Officials want the West's capital and equipment but have ambivalent feelings about western ownership of 'national patrimony.'"

The picture is complicated further by frictions between the republic governments and the Union government. A pattern has developed: the Union government awards western oil firms oil concessions in politically truculent republics, the locals in turn quickly sabotage the Moscow-inspired plan to take their resources. When local governments in turn have made their own arrangements with western firms, the ventures seem predestined to snag on Moscow's red tape.

Until the Soviets can sort out their political legal problems, western oil firms, for the most part, will look at but not touch Soviet energy investments.

Table 1

How gas resource estimates have changed

Province	Probable			Possible			Speculative		
	Minimum	Most likely	Maximum	Minimum	Most likely	Maximum	Minimum	Most likely	Maximum
Onshore, less than 15,000 ft									
Arkoma basin 12/90	2,556	3,244	3,966	1,731	2,315	3,191	1,364	1,881	2,473
Arkoma basin 12/88	2,250	3,500	4,100	1,000	1,550	1,750	1,200	1,800	2,050
Anadarko basin, Palo Duro basin, etc. 12/90	10,450	16,100	26,300	8,400	14,950	27,000	10,800	20,100	39,100
Anadarko basin, Palo Duro basin, etc. 12/88	10,300	16,600	27,300	8,600	16,000	28,700	11,200	22,500	41,300
Onshore 15,000-30,000 ft									
Arkoma basin 12/90	200	300	350	250	400	500	300	500	650
Arkoma basin 12/88	200	300	350	250	400	500	300	500	650
Anadarko basin, Palo Duro basin, etc. 12/90	4,800	8,300	16,100	5,400	9,400	18,300	2,300	4,100	8,100
Anadarko basin, Palo Duro basin, etc. 12/88	4,800	9,000	21,800	5,000	9,200	22,200	2,700	5,000	11,900

Source: Potential Gas Committee, Colorado School of Mines

New field wildcatting was at a low level, and most drilling consisted of increased density spots in existing fields. Numerous wells turned up new pay discoveries in existing fields in western Oklahoma and the Texas panhandle.

Several horizontal wells were completed in widely spaced areas of Oklahoma.

Arkoma permitting steady as Oklahoma, Arkansas fall

The basin has maintained a fairly steady level of activity during the last 5½ years, based on the number of applications for permits to drill (APDs) filed.

The average number of Arkoma basin APDs filed since the beginning of 1986 has varied only slightly, with a low of 41/month during January-May 1991 vs. a high of 54/month in 1988, figures from Dwights Energydata Inc., Oklahoma City, showed. By contrast, the number of APDs filed statewide since first quarter 1986 is down 62% in Arkansas and 54% in Oklahoma.

While as recently as late 1990 there were reports of rig shortages in the Arkoma, operators said contractors kept up with permitting during 1991.

Cambro-Ordovician Arbuckle and overthrust Pennsylvanian Spiro-Wapanucka have been the focus of the boom, but older fields in the basin also have benefited from attention drawn to the area.

Spiro-Wapanucka play moving east, south

A string of Spiro-Wapanucka gas fields has sprung up since 1988 along an approximately 30 mile front from south of Haileyville in Pittsburg County, Okla., to south of Panola in Latimer County.

The fairway is as wide as 8 miles and contains the potential for wells with reserves of 6-30 bcf.

Development drilling was particularly intense in South Panola field, which Anson Co., Oklahoma City, discovered in October 1990.

Five South Panola field wells of record had produced a combined 13.4 bcf of gas through July 1991, and the field had 17 other wells in various stages of progress in two townships.

Dry hole costs to drill overthrust Spiro at 14,000-16,500 ft surpass \$2 million while drilling and completing an overthrust Spiro well costs \$3-3.5 million.

ARCO Oil & Gas Co. completed another discovery between South Wilburton and South Panola fields.

The 1 James, 7 miles south of Wilburton, flowed 3.976 MMcf/d of gas through a 2½ in. choke with 2,157 psi flowing tubing pressure from Pennsylvanian Spiro perforations at 14,597-644 ft without treatment.

The company estimated the well's reserves at 15 bcf of gas.

To the west in Latimer County, South Hartshorne field through April 1991 had produced 34.3 bcf of gas from 14 wells completed in Spiro.

Arbuckle exploration down but not out

Unsuccessful outcomes at numerous Arbuckle wildcats in the basin and downgrading of reserve estimates at the basin's only significant Arbuckle discovery have driven some newcomers away and disillusioned many stalwart operators.

ARCO Oil & Gas Co. originally estimated Wilburton field Arbuckle reserves at 500-600 bcf, or 42-50 bcf/well. But as of spring 1991 the field had produced only 186 bcf. ARCO isn't saying whether it has adjusted its reserve estimate, but others have insisted the field will ultimately produce only about 350 bcf.

The company completed the 15th Wilburton Arbuckle producing well in mid-1991 flowing 5.4 MMcf/d of gas from open hole at 13,880-14,100 ft.

Helmerich & Payne Inc. completed the 16th Wilburton Arbuckle producing well in late 1991. It redrilled a well in 18-5n-19e that Exxon had abandoned in late 1990.

H&P's sidetrack flowed 12.676 MMcf/d of gas and 73 b/d of load water from Arbuckle at 13,558-14,185 ft.

All of the basin's deepest Arbuckle penetrations have been noncommercial, and only a few of those expensive wells have been completed in economic shallower formations. Steeply dipping formations, high drilling costs, and misinterpreted seismic data have been blamed for the failures.

Mobil Oil Corp. set a drilling depth record for the basin at its 1 Green Bay Packaging well in LeFlore County. The wildcat, which was intended to test Arbuckle, was dry at a total depth of 21,935 ft.

Exxon Co. USA held the old record, 19,046 ft, at its 1 Betherford dry hole completed in 1985 in Latimer County.



deep water, adverse weather, relatively heavy oil, and complex reservoir properties. The development will require innovations such as horizontal drilling, subsea wells, and floating production systems, it said.

Alcorn Production Philippines Inc planned to use two horizontal wells to drain the northeast and southern margins of West Linapacan A field off Palawan Island.

Latin America, Africa getting horizontal wells

Horizontal wells were drilled during the year in Bolivia and Mexico, and Argentina and Ghana were studying their use.

Yacimientos Petroliferos Fiscales Bolivianos drilled that country's first horizontal well VGB-29, during the year to improve production and recovery efficiency in Vuelta Grande field.

The field, 18.5 miles southeast of Sucre, had been on production 18 months, with 16 wells producing 90 MMcf/d of gas and 2,600 b/d of condensate.

The well, with horizontal displacement of 1,673 ft in the productive formation, is bottomed at 5,638 ft subsea, about 100 ft above the common hydrocarbon-water contact of the Cretaceous Tapecua and Triassic Cangapi formations.

Mexico in 1991 was drilling its first horizontal wells. The first, in Agua Fria field near Poza Rica in the Veracruz region northeast of Mexico City, was to have a 3,940 ft horizontal section at 9,020 ft MD.

Total Austral said horizontal wells might be needed to develop oil in four satellite fields in Argentina near Hydra field off Tierra del Fuego.

Total said the four fields could hold a combined 35 million bbl of reserves. It said the fields could be developed by the mid-1990s to maintain oil flow through Hidra facilities.

Ghana National Petroleum Corp. was studying the use of horizontal drilling to increase production from South Tano oil field and reactivate production in Saltpond field offshore.

Canadian horizontal drilling is updated

Several hundred horizontal wells have been drilled in

Estimated horizontal well costs for 1990

State/area	Horizontal wells	Total footage	Total cost	State cost per foot
			\$	
Alabama	1	15,354	1,347,753	87.78
California-East Central	1	1,680	119,592	71.19
Colorado	6	41,523	1,309,654	31.54
Illinois	1	3,005	53,350	17.75
Louisiana-North	11	17,557	492,360	28.04
Louisiana-Offshore	2	16,781	5,520,103	328.95
Michigan	1	10,877	1,423,708	130.89
Mississippi	2	10,964	2,826,013	257.75
Montana	6	57,421	4,572,368	79.63
New Mexico-East	1	4,900	200,239	40.87
New Mexico-West	1	6,107	139,658	52.34
North Dakota	70	901,561	94,353,014	104.66
Oklahoma	6	26,949	1,959,497	72.71
Texas Dist. 1	571	5,266,468	434,770,197	82.56
Texas Dist. 3	89	957,464	99,590,701	104.02
Texas Dist. 5	1	3,409	276,000	80.96
Texas Dist. 6	3	24,483	2,232,172	91.17
Texas Dist. 7B	5	42,968	1,454,857	33.86
Texas Dist. 7C	1	8,180	262,249	32.06
Texas Dist. 8A	3	22,734	1,176,369	51.74
Wyoming	9	65,731	7,440,219	113.19
Total	791	7,506,116	961,709,873	88.11

Source: American Petroleum Institute; Joint Association Survey on Drilling Costs

Carniola

Among the most successful areas for horizontal completions in Canada are Suffield, Alta. and Long Lake and



age to help Algeria's state owned Sonatrach refurbish and hike capacity of a liquefaction plant at Skikda, Algeria. Eximbank approved a repayment guarantee to cover the sale to Sonatrach of U.S. equipment and engineering services by Sofregaz U.S. Inc., Houston, an engineering and construction subsidiary of Gaz de France.

The bank said the Algerian hydrocarbon sector generated more than 96% of Algeria's export earnings and 55% of total government revenue.

Sonatrach will refurbish and expand three of its four liquefaction plants to serve new long term LNG sales contracts. It estimated the total project will cost \$2.2 billion.

Eximbank since 1967 has approved \$1.2 billion in authorizations for Sonatrach, and 1991 exposure was \$307 million. In the 1991 deal, the bank agreed to guarantee repayment of \$42.5 million of the \$50 million Sofregaz contract price. To meet export credit competition from other countries, the bank also guaranteed financing for local costs equal to 15% of the contract price, or \$7.9 million.

The bank guaranteed repayment of a loan for purchase of \$67.4 million of gas separation equipment and services from Air Products & Chemicals Inc., Allentown, Pa. Air Products will provide equipment and engineering services for construction of a helium separation plant adjoining the LNG plants at Bethioua on the west coast of Algeria. It will build the plant, train operators, and oversee operation.

Eximbank also agreed to guarantee repayment of a \$59.2 million loan from the Private Export Funding Corp. to Helios Spa of Arzew, Algeria, a joint venture owned 51% by Sonatrach and 49% by Helap, which is jointly owned by subsidiaries of Air Products and Air Liquide of France.

Australia

The Woodside Offshore Petroleum Pty. Ltd. group's Northwest Shelf LNG project set an Australian construction safety mark in August 1991 when the Train 3 construction program completed 2 million man-hr of work without a lost time injury.

It marked completion of almost 2 years of continuous construction work without a lost time injury, since work started in September 1989, on the \$1 billion third train and other onshore facilities. Addition of the train will boost capacity of the group's plant on the Burrup Peninsula near Karratha, Western Australia, to 6 million metric tons/year starting in 1993.

Woodside's first two trains started up in June 1989 at a

cost of \$2.6 billion (Australian). The first tanker shipment of LNG to utilities in Japan was completed the following August.

The KJK joint venture, made up of Kellogg Overseas Corp., JGC Corp., and Kaiser Engineers Australia, is engineering, procurement, and construction contractor.

Indonesia

Indonesia's Pertamina in September obtained financing for another train at the Bontang LNG complex in East Kalimantan. The expansion is to aid Pertamina in supplying LNG to three Japanese companies.

A group of international banks agreed to provide a

Table 1
1990 LNG trade contracts

Exporter	Importer	Contract volume (bct/year)	Tankers employed
Algeria	France	353.2	5
	Belgium	190.7	2
	Spain	120.1	6
	U.S.	243.7	4
	U.K.	7.1	1
	Japan	14.1	1
Libya	Italy	*	1
	Spain	38.8	3
U.S.	Japan	102.4	2
Brunei	Japan	254.3	7
Abu Dhabi	Japan	98.9	5
Malaysia	Japan	300.2	5
Australia	Japan	300.2	3
Indonesia	Japan	748.7	15
	Taiwan	74.2	1
	Korea	98.9	2

*Not available.

Source: American Gas Association from Gotase-Larsen Shipping Corp. data

Table 2
How selected prices compare

	LNG cif Japan	Natural gas EC western Europe wellhead U.S. \$/MMBTU	U.S. imports U.S. \$/MMBTU	Crude oil cif IEA countries
1975	1.7	1.0	0.4	1.8
1976	1.8	1.4	0.6	2.6
1977	2.1	1.7	0.8	2.9
1978	2.4	1.9	0.9	3.3
1979	2.8	2.1	1.2	3.9
1980	5.1	3.0	1.6	4.2
1981	5.8	3.6	2.0	4.7
1982	5.7	4.0	2.5	4.8
1983	5.1	3.8	2.6	4.3
1984	4.9	3.7	2.7	4.0
1985	5.0	3.8	2.6	3.1
1986	3.9	3.6	2.0	2.5
1987	3.4	2.6	1.7	2.1
1988	3.2	2.3	1.7	2.0
1989	3.2	2.1	1.8	2.0
1990	3.6	*2.8	*1.7	*2.0

*Based on prices for first 9 months.

Source: British Petroleum Co. plc from International Energy Agency data

syndicated loan for the project. The Jakarta Post quoted A. Sidik Nitikusuma, a spokesman for Pertamina, as saying the \$750 million loan was being coordinated by Chase Manhattan Bank and Mitsubishi Bank of Japan.

The train will be added to supply 2.1 million tons/year of LNG to Osaka Gas Co., Tokyo Gas, and Toho Gas Co. under 20 year contracts. Deliveries of increased volumes from the Bontang complex are to begin early in 1994.

Pertamina Pres. Faisal Abda oe said his company will be able to repay the loan in 10 years using only 60% of the value of LNG exports from the project.

The loan has a 13 year maturity, including a 3 year grace period, and will have an interest rate of 1.25% year above the London interbank offered rate.

An Indonesian firm, Inti Karya Persada Teknik, is building the train, designed by Chiyoda Corp. of Japan.

Pertamina in 1991 was operating five LNG trains, each with a design capacity of 2.3 million tons/year, at Bontang on Borneo Island and six others, each rated at 2 million tons/year, at Arun on Sumatra Island. The sixth LNG train at Bontang will increase Indonesia's LNG exports to Japan, South Korea, and Taiwan to 24 million tons in 1994 from 20.63 million tons in 1990.

Malaysia

Royal Dutch-Shell Group companies in Sarawak and Sabah, Malaysia, were poised for major increases in off-shore spending. Outlays were to focus in part on supplying more gas for expansion of Malaysia LNG Sdn Bhd's Bintulu, Sarawak, liquefaction plant.

The biggest volume of additional gas will be required by the second phase of Malaysia LNG. When a \$1.7 billion expansion is complete in 1996, gas consumption will rise to 2.4 bcf/d from 1 bcf/d. Addition of three LNG trains will boost plant capacity to 15 million metric tons/year from 8 million metric tons/year. The expansion is to include a new shipping jetty and new storage tank.

Production from the first phase of the LNG operation, which started up in 1983, is sold under long term contracts to Japan. Shipments of second phase production will include 2.3 million metric tons/year to Taiwan and an additional 2.5 million metric tons/year to Japan.

The number of LNG vessels required for the project will

rise to 12 from the 1991 fleet of six.

State owned Petrolia Nasional Bhd. (Petroneas) owns a 60% interest in the first phase of the project. Its partners are Shell Gas BV and Mitsubishi Corp. 17.5% each and the Sarawak state government 5%. In phase two, Shell and Mitsubishi's interests will be cut to 15% each, with a corresponding increase in the shares held by the two government bodies.

Nigeria

Plans for Nigeria's first liquefaction plant took a major jump in mid-1991 when Nigeria LNG Ltd. wrapped up terms for sale of the entire production from the proposed plant at Finima, Rivers state. Sources said although behind schedule, exports of Nigerian LNG to Europe and the U.S. appear to be possible within the following 6 years.

Lined up as buyers for Nigerian LNG were the Italian state power generation company ENEL, Spain's Enagas, Gaz de France, and Distrigas Corp. of the U.S. The four buyers will take all the plant's 4.6 million metric tons/year for 22½ years, which includes the initial supply and buildup periods.

Pierre Gadonneix, general manager of Gaz de France, said the Nigerian contract will amount to only 1.85% of the company's imports. But it is in line with the policy of diversifying sources of supply. In 1991 they were Netherlands, U.S.S.R., and Algeria in addition to domestic gas. He said Gaz de France is prepared to extend the contract if and when Nigeria decides to expand the project.

Nigeria LNG, a joint venture of Nigerian National Petroleum Corp. 60%, Shell Gas BV 20%, Agip International BV 10%, and Ste. Nationale Elf Aquitaine unit Cleag Ltd. 10%, said it needs to complete project financing, which could take about a year. This places first deliveries from the \$4 billion project early in 1997, 2 years behind the original start-up date.

Ahmed Joda, chairman of Nigeria LNG, said France's Technip and M.W. Kellogg completed a \$17 million design specification for the plant in 1990, which led to the \$4 billion cost estimate. He said the project will be financed by shareholders equity and loans on a 40-60 basis.

The 2 year delay in start-up for gas delivery is partly due to long marketing negotiations and to "a rather optimistic project schedule" established when the project was disclosed in 1989.

The liquefaction plant will require about 5.7 billion cu m/year of gas, which will be delivered from local sources through a new 125 mile pipeline network included in the overall project.

Tender documents for the next phase of work—engineering, procurement, and construction of the plant, gas pipelines, telecommunications system, and residential area—were to be released to two groups of companies that emerged from a prequalification process involving about 26 companies.

Technip and Kellogg were to bid in partnership with Italy's Snamprogetti SpA and Japan's JGC Corp. Ranged against them were to be Bechtel Corp., Japan's Chiyoda Corp., Germany's Thyssen, and France's Spie Batignolles.

Joda said the contract will be let in 1992.

Four LNG vessels have been acquired for the project. The LNG Finima and LNG Bonny are chartered to Malaysian LNG and Pertamina for work in the Far East. The two other vessels, LNG Lagos and LNG Port Harcourt, are laid up.

Portugal

Portugal, with no oil or gas production, decided in 1991 to join the world's list of LNG importers. The Portuguese government chose a group made up of French, German, and Portuguese companies to implement its proposed introduction of natural gas to the country.

Discussions with the group to draft a licensing agree-

At about 880 ft, the Hamills found oil shows that, based on their experience with wells near Corsicana, they estimated could produce 50 b/d.

The Hamills halted operations Christmas day 1900, resuming work Jan. 1, 1901. On Jan. 10 at a depth of 1,160 ft they pulled the drillpipe from the hole to change bits.

The bit had been changed and about 700 ft of drillpipe had been lowered back into the wellbore when mud began bubbling out of the hole, ushering in a new era on the 10th day of the 20th century.

In seconds, 6 tons of 4 in. drillpipe, swivels, blocks, and tackle shot skyward, propelled by a highly pressured slug of drilling slurry, mud, rocks, and sand. The drillstem blasted through the top of the derrick and broke into joints as it crashed to earth around the wellhead.

For a few moments, all was silent. The drilling crew, dazed and fearful of what they had seen, crept back onto the rig floor, now strewn with thick mud and debris.

Almost immediately, mud again shot out of the wellbore, this time with a report like a cannon. A low rumble, deep within Spindletop grew to an ear-splitting roar. Gas spewed from the hole, followed by a column of oil that gushed out the top of the derrick, doubling its height before dousing everything within a wide radius around the well.

In an instant, the drudgery of drilling with the era's inefficient methods and tools was replaced with dread of controlling an awesome blowout of unprecedented volume.

Lucas responded with creativity, considering the primitive state of oil field technology. He hired gang plows and 40 four-horse teams to build levees to contain the oil. He hired guards to keep crowds away from the site. And he wired Guffey and Galey in Pittsburgh about the event, estimating the well's production at 35,000 b/d.

Other estimates of the day placed Spindletop's initial flow at about 75,000 b/d of oil. As hours passed on the first day, the uncontrolled flow increased. In 9 days, 1 Lucas, as the discovery well became known, created a lake of about 800,000 bbl of oil.

The first levees built by Lucas' gangs soon were filled and larger ones had to be built. Still 1 Lucas roared on.

On Jan. 13, a catastrophe was narrowly averted when guards and onlookers smothered a grass fire that broke out on the oil-soaked ground around the well.

Galey, Lucas, and the Hamills finally controlled 1 Lucas and shut it in Jan. 19. To protect the well from fire, they installed a large iron cylinder around the wellhead and filled it with sand.

The wisdom of the latter safety measure was proved Mar. 3, when sparks from a passing train set off a grass fire that quickly spread to engulf Spindletop's oil-filled levees. A single gigantic blaze consumed more than 500,000 bbl of Spindletop crude. But 1 Lucas was not damaged.

Birth of an industry

The Lucas blowout, the largest discovery the U.S. had seen, sparked one of the country's greatest oil booms.

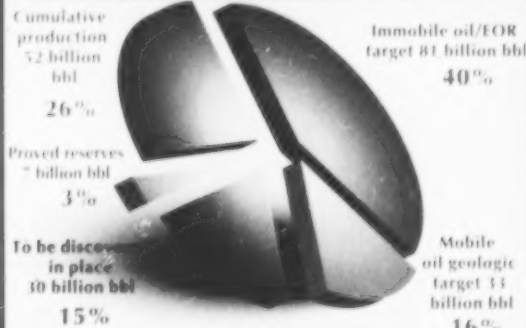
Contrary to prevailing opinion at the time, 1 Lucas suggested that vast volumes of oil could be recovered at relatively shallow depths from salt domes along Texas Coastal Plain. In the decade that followed, explorationists tested scores of similar structures along the Gulf Coast in a futile search for another Spindletop.

Spindletop's oil was of poor quality for refining into kerosene for lighting, the main use of hydrocarbon fuels up to that time. Instead, its production was refined into fuel oil. As a result, a host of small Texas industrial operations converted from coal to fuel oil for heating, power, and in some cases transportation.

Coal-to-oil conversions soon followed all over the U.S. Santa Fe Railroad for one, increased its oil-fired locomotives from one unit in 1901 to 227 in 1905. Consequently, the

Remaining unrecovered oil in existing fields

114 billion bbl



Source: Bureau of Economic Geology, University of Texas at Austin

Lucas discovery at Spindletop is credited with transforming a nation as well as an industry by giving birth to a transportation industry powered by a seemingly unlimited supply of hydrocarbon fuels.

The news of Spindletop transformed Beaumont, which quickly changed from a quiet rural haven of 10,000 souls to a heavily, roaring boom town of 50,000 as hordes of sightseers, speculators, fortune hunters, and other boomers poured in from all around the world.

By many accounts, the streets of Beaumont resembled a nonstop riot, and denizens of local saloons reportedly accounted for half of the state's whisky consumption. Brawling was common enough to be considered a favored pastime, but murder was relatively rare.

Deals were cut at all hours of the day and night. Many dishonest schemers promoted phony deals and worthless stock, trumped up by false claims and inaccurate newspaper and magazine articles. So numerous were victims of fraudulent deals that local wags renamed their landmark "Swindletop."

Skyrocketing land values couldn't stem the tide of shanties, tents, lean-tos, and other rude shelters hastily erected in and around Beaumont and on Spindletop itself.

More than 400 oil and gas companies were chartered in the first year with combined capitalization of about \$200 million. Included were predecessors of many major integrated U.S. firms.

- The Texas Co., founded by J.S. Cullinan and Arnold Schlaet, later became Texaco Inc.

- Humble Oil & Refining Co., which merged in 1959 with a company known today as Exxon Corp.

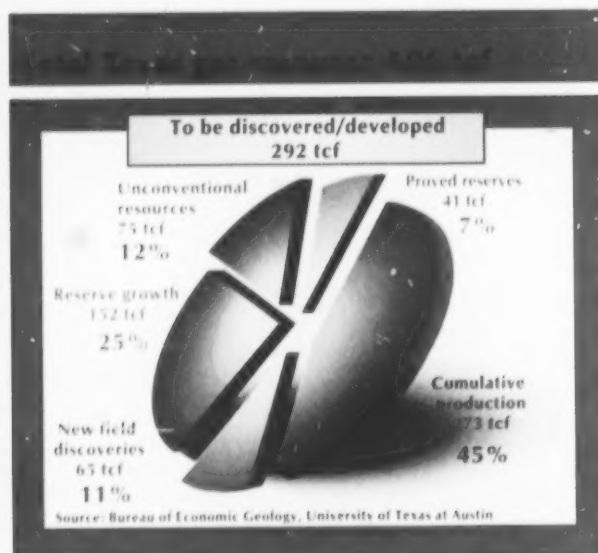
- Sun Co. Inc., founded in northern Ohio in 1886, quickly joined the Spindletop play and in 1902 began processing Texas crude in a refinery at Marcus Hook, Pa.

- Founded later, in 1907, Gulf Refining Oil Co., which was acquired by Chevron Corp. in 1984.

Guffey cut a deal with Shell Transport & Trading, which agreed to pay him 25¢ bbl for half his production for the next 20 years.

Among the few impediments to development, most limiting was a lack of oil field equipment and railroad cars to move products out of the area. Well productivities often were described in terms of production tubing size—4 in. or 6 in. gushers, for example.

By the end of August 1901, more than 40 flowing wells had been completed, each a risky event. A greater danger,



however, was the practice of whetting investors' avarice by allowing wells to flow anew to demonstrate productive capacity. Promoters commonly stopped coaches jammed with investors alongside a well site and fully opened wellhead valves. A committee of Spindletop oil producers put a stop to the promotional technique with a list of safety rules, among the world's first organized attempts to control oil field hazards.

By yearend 1901:

- 138 wells had been completed at Spindletop, and more than 5 million bbl of oil was produced and gathered.
- Capital investment on oil and gas exploration and development around Beaumont totaled nearly \$4 million.
- Spindletop producers held about 1.6 million bbl of oil in storage. About 3.6 million bbl had been sold for almost \$631,000.

Within a year of the Lucas discovery, 285 wells were producing in Spindletop field, where wellheads were so close to each other that rig hands could step from one derrick floor to the next without setting foot on the ground.

But by the middle of 1902, hundreds of tightly packed wells had resulted in overproduction, and Spindletop production plummeted.

Strikes across Texas

In the same way success at Corsicana had encouraged Higgins to continue pressing his vision of Spindletop's potential, the boom touched off by 1 Lucas inspired a quick succession of discoveries across Texas.

Texas petroleum industry development in the decade after Spindletop also began to focus more on gas prospects.

The state's third major oil producing area appeared in North Texas near Petrolia in Clay County, where shallow shows of oil had been found for many years. Like the discovery at Corsicana, the 1902 discovery in Clay County occurred by accident, when crews drilling for water on the Lochridge farm near Petrolia cut a productive oil sand at 150 ft.

Mission field near San Antonio was recognized as the state's fourth sizable producing area in 1907.

Meanwhile, work in Petrolia field in 1907 was credited with launching the state's gas industry. In October of that year, Navarro Refining Co. completed a gas well at 1,500 ft in the field that recorded 475 psi surface pressure.

Gas from Navarro Refining's well and three others soon

was being piped to Petrolia and to Wichita Falls in Southeast Wichita County. Based on the success of that project, on June 4, 1909, a group led by L.B. Denning filed a charter to organize Lone Star Gas Co. for the purpose of laying a gas pipeline to transport gas from Clay County to Dallas and Fort Worth. Lone Star became the state's first major gas company.

By spring 1910, Dallas, Fort Worth, and several smaller communities in the area were receiving gas through the Lone Star line.

Sustained expansion

Scores of oil and gas discoveries were recorded across Texas during 1911-20, a period of sustained expansion for the state's petroleum industry.

Among the most noteworthy finds:

- In July 1918 in Liberty County, Southeast Texas, 3 Fee well by Republic Production Co. and Houston Oil Co. of Texas proved the Hull salt dome productive.
- During the same month in North Texas, the Fowler well on the edge of Burkburnett in Wichita County found oil, touching off a boom in which stock speculation reportedly raved or surpassed the excesses at Spindletop.
- Amarillo Oil Co. on Sept. 1, 1918, cut gas pay above 2,300 ft in the Texas Panhandle, opening the region to development. Upon completion Dec. 9, 1 Masterson flowed 10 MMcf of gas. Oil development in the Panhandle was delayed until a discovery in 1921.

The decade also was marked in 1917 by the first widespread labor dispute when members of the Oil Field Workers' Union of South Texas and Louisiana on called a strike Nov. 1 to demand shorter hours, better pay, and recognition of the union.

The walkout briefly halted some operations, but by the end of November soldiers were occupying all major Texas oil and gas fields, and order prevailed. However, neither side showed a willingness to compromise on the issues.

The Federal Mediation Commission dispatched a mediator to try to find grounds for settling the disagreement. In January 1918, more than 200 Texas and Louisiana operators meeting in Houston organized the Texas Gulf Coast and Louisiana Oil and Producers Association to consider solutions recommended by the commission. And by the end of the year, Texas oil and gas activity had returned to normal.

Regulatory framework

Prompted by problems caused by many haphazard development programs across the state early in the 20th century, the Texas Legislature began expanding state authority over oil and gas.

By Oct. 9, 1930, when Dad Joiner's 3 Daisy Bradford wildcat found oil in Rusk County, marking discovery of East Texas field and undermining world oil prices with a flood of new supplies, much of the regulatory framework needed for efficient oil field operations had been put in place.

However, enforcing state conservation law on a generally resistive industry was another matter.

Texas legislators passed the first law giving the Texas Railroad Commission (TRC) authority to enforce the state's oil and gas conservation laws with a 1917 act that declared pipelines common carriers.

In 1919, state legislators created the commission's oil and gas division and continued delegating to the TRC authority to oversee oil field activity in the state by passing a law mandating conservation and forbidding waste of Texas oil and gas resources.

In June 1920, the legislature declared production and sale of gas a public utility and placed TRC in charge.

A law passed in March 1929 set conditions under which pipelines could be built in or through Texas to deliver

International Active Rig Count

Region	1984	1985	1986	1987	1988	Land	1989 Off.	Total	Land	1990 Off.	Total	Land	1991 Off.	Total
NORTH AMERICA														
Canada	259	311	178	181	196	129	1	130	138	0	138	120	1	121
United States*	2,428	1,980	964	936	936	746	123	869	902	108	1,010	762	98	860
Subtotal	2,687	2,291	1,142	1,117	1,132	875	124	999	1,040	108	1,148	882	99	981
LATIN AMERICA														
Argentina	82	81	47	61	63	54	1	55	63	1	64	60	0	60
Bolivia	6	5	4	6	5	6	0	6	6	0	6	10	0	10
Brazil	70	76	77	60	39	21	7	28	16	7	23	14	7	21
Chile	6	6	6	7	5	3	2	5	3	3	6	3	3	6
Colombia	16	21	17	14	19	15	0	15	11	0	11	9	0	9
Costa Rica	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Ecuador	4	2	3	3	6	5	0	5	2	0	2	7	0	7
Mexico	196	196	163	143	155	69	34	103	57	33	90	76	33	109
Peru	17	12	13	15	11	6	4	10	4	2	6	2	1	3
Trinidad	9	10	11	9	7	2	4	6	3	5	8	2	4	6
Venezuela	30	33	29	18	25	18	10	28	20	12	32	28	17	45
Other	3	2	1	1	0	0	0	0	0	0	0	0	0	0
Subtotal	440	444	371	338	335	199	62	261	185	63	248	211	65	276
FAR EAST														
Australia	34	31	15	16	19	7	7	14	8	6	14	7	5	12
Bangladesh	4	5	5	5	2	4	1	5	4	0	4	0	0	0
Brunei	9	7	5	3	4	1	3	4	1	4	5	1	3	4
China-offshore	9	14	7	4	8	0	4	4	0	3	3	0	2	2
India	57	62	70	116	131	110	25	135	110	27	137	114	22	136
Indonesia	82	80	62	37	44	36	10	46	36	16	52	39	14	53
Japan	18	16	15	10	11	6	0	6	6	1	7	5	1	6
Malaysia	9	8	8	8	9	1	11	12	0	13	13	0	13	13
Myanmar (Burma)	33	33	33	29	26	23	0	23	19	0	19	22	0	22
New Zealand	2	4	4	3	2	2	0	2	0	1	1	1	0	1
Papua New Guinea	1	2	1	2	3	2	1	3	2	1	3	2	0	2
Philippines	3	2	1	2	4	6	1	7	6	0	6	4	1	5
Taiwan	6	7	7	4	4	4	1	5	2	1	3	2	1	3
Thailand	11	9	4	6	6	3	3	6	2	3	5	1	3	4
Other	0	0	0	0	1	0	1	1	0	1	1	0	0	0
Subtotal	278	280	237	245	274	205	68	273	196	77	273	198	65	263
AFRICA														
Algeria	27	35	41	40	32	24	0	24	35	0	35	31	0	31
Angola	7	11	7	10	10	1	7	8	1	7	8	0	6	6
Congo	3	3	2	3	2	0	1	1	0	2	2	1	2	3
Gabon	6	7	3	3	5	3	3	6	3	2	5	3	2	5
Kenya	0	0	0	1	1	3	0	3	1	0	1	0	0	0
Libya	26	30	20	12	16	13	4	17	12	3	15	14	1	15
Nigeria	11	10	10	11	13	10	4	14	12	6	18	8	13	21
South Africa	2	3	3	3	4	0	3	3	0	3	3	1	1	2
Tunisia	6	4	3	4	3	3	0	3	2	1	3	4	2	6
Other	18	16	7	4	5	2	2	4	2	0	2	0	0	0
Subtotal	106	119	96	91	91	59	24	83	68	24	92	82	27	89
EUROPE														
Austria	7	7	6	4	4	2	0	2	1	0	1	2	0	2
Denmark	3	4	3	3	2	0	2	2	0	2	2	0	2	2
France	20	22	15	8	8	7	0	7	6	0	6	4	0	4
Germany	19	20	19	12	9	8	0	8	8	1	9	7	0	7
Greece	4	1	0	2	2	1	0	1	0	0	0	0	0	0
Holland	18	24	15	10	14	4	8	12	3	11	14	3	8	11
Hungary	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	0	4
Italy	26	40	33	26	24	17	5	22	16	5	21	19	6	25

International Active Rig Count—continued

Region	1984	1985	1986	1987	1988	1989			1990			1991		
						Land	Off.	Total	Land	Off.	Total	Land	Off.	Total
Norway	10	13	12	12	15	0	12	12	0	12	12	0	16	16
Poland	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	22	0	22
Spain	9	10	7	2	2	1	2	3	1	0	1	0	1	1
Turkey	24	25	27	26	21	20	0	20	17	0	17	19	0	19
United Kingdom	60	63	43	44	57	4	42	46	2	46	48	1	38	39
Yugoslavia	25	27	30	31	31	29	3	32	30	1	31	15	0	15
Other	2	2	1	1	1	0	0	0	0	0	0	1	0	1
Subtotal	227	258	211	181	190	93	74	167	84	78	162	97	71	168
MIDDLE EAST														
Abu Dhabi	29	21	15	9	7	2	4	6	4	5	9	6	7	13
Dubai	7	5	3	2	3	0	3	3	0	3	3	1	2	3
Egypt	36	37	33	23	21	6	12	18	6	9	15	9	8	17
Iran	20	20	18	18	18	20	0	20	19	0	19	20	1	21
Iraq†	19	28	21	10	23	26	0	26	23	0	23	N/A	N/A	N/A
Jordan	3	2	2	2	2	3	0	3	2	0	2	2	0	2
Kuwait†	5	6	6	6	6	4	0	4	2	0	2	1	0	1
Oman	12	13	13	10	9	13	0	13	17	0	17	14	0	14
Pakistan	17	18	17	14	13	13	0	13	11	0	11	10	0	10
Qatar	2	3	1	1	3	1	2	3	1	1	2	2	1	3
Saudi Arabia	16	11	6	5	4	4	1	5	9	1	10	15	1	16
Syria	23	26	27	22	24	24	0	24	17	0	17	14	0	14
Yemen	0	1	4	4	3	2	0	2	3	0	3	5	0	5
Other	1	3	3	1	0	1	0	1	1	0	1	0	0	0
Subtotal	190	194	169	127	136	119	22	141	115	19	134	99	20	119
Total	3,928	3,586	2,226	2,099	2,158	1,550	374	1,924	1,688	369	2,057	1,549	347	1,896

*U.S. offshore includes inland water rigs: 19 in 1989, 21 in 1990, 17 in 1991.

†1990 data for Iraq and Kuwait is average rigs January through August.

Source: Baker Hughes Inc.

International seismic crew count

	1986			1987			1988		
	Land	Marine	Total	Land	Marine	Total	Land	Marine	Total
				(Average crews operating)					
United States.....	161	22	183	154	24	178	147	29	176
Canada.....	53	1	54	58	1	59	69	1	70
Mexico.....	29	0	29	23	0	23	21	0	21
Central & South America.....	48	5	53	46	5	51	53	4	57
Europe.....	65	26	91	52	25	77	49	26	75
Middle East.....	33	4	37	35	3	38	42	2	44
Africa.....	44	4	48	37	5	42	36	6	42
Far East.....	74	9	83	87	9	96	75	11	86
Total.....	507	71	578	492	72	564	492	79	571
	1989			1990			1991*		
	Land	Marine	Total	Land	Marine	Total	Land	Marine	Total
				(Average crews operating)					
United States.....	109	22	131	102	23	125	88	23	111
Canada.....	57	1	58	51	1	52	49	0	49
Mexico.....	17	0	17	18	0	18	22	0	22
Central & South America.....	53	5	58	48	5	53	53	4	57
Europe.....	42	25	67	38	25	63	37	34	71
Middle East.....	41	2	43	37	2	39	31	1	32
Africa.....	46	8	54	50	7	57	43	9	52
Far East.....	58	14	72	60	16	76	62	17	79
Total.....	423	77	500	404	79	483	385	88	473

*First half.

Source: Society of Exploration Geophysicists

E&P SPENDING

Breakout of exploration/production spending*

		1991 1990 (Million U.S. \$)		1991 1990 (Million U.S. \$)		1991 1990 (Million U.S. \$)	
MAJORS U.S.							
Amerada Hess		300	250				
Amoco		835	900				
ARCO		1,850	1,625				
BP		1,200	1,100				
Chevron		1,280	1,100				
Du Pont		720	550				
Elf Aquitaine		100	90				
Exxon		1,470	1,400				
Mobil		1,150	1,000				
Phillips		309	349				
Occidental		170	217				
Oryx		300	350				
Pennzoil		170	165				
Royal Dutch/Shell		1,895	1,700				
Texaco		900	1,100				
Total Minatome		50	55				
Union Pacific		355	370				
Unocal		530	540				
USX		525	550				
Total		14,109	13,411				
Change		+5.2%					
SELECTED INDEPENDENTS, U.S.†							
Adobe		49	68				
AMAX		45	27				
Anadarko		185	150				
Apache		127	124				
Arkia		70	70				
Ashland		47	43				
Berry		20	14				
BHP		120	94				
Bridge Oil		31	10				
Brooklyn Union		36	23				
Burlington Resources		348	287				
Cabot		45	40				
Canadian Occidental		46	46				
Chieftain		32	30				
Coastal		110	93				
Coho		23	34				
Columbia Gas		165	180				
Consolidated Natural		130	170				
Corpus Christi Oil & Gas		44	51				
Dekalb Energy		33	33				
Diversified Energies		34	25				
Enron		264	255				
Enserch		197	117				
Equitable Resources		58	56				
Forest Oil		61	64				
Freeport-McMoRan		185	185				
Global Natural Resources		20	28				
Grace Energy		36	26				
Helmerich & Payne		27	17				
Hondo		28	32				
Howell		20	9				
J.M. Huber		30	32				
Kelley Oil et al.		50	25				
Kerr-McGee		145	145				
Lasmo		17	28				
Louisiana Land		165	155				
Maxus Energy		125	120				
Mesa		48	40				
Mitchell Energy		142	132				
Murphy		47	42				
National Fuel Gas		30	25				
Nicor		32	35				
Noble Affiliates		77	91				
Nomeco		49	54				
Noranda		41	59				
Norcen Energy		64	53				
Odeco		81	55				
Pacific Enterprises		155	175				
Paramount		20	12				
Parker & Parsley		100	98				
Petrofina		168	137				
Plains		23	14				
Pogo Producing		58	41				
Presidio		60	45				
Public Service Enterprise		114	85				
Questar		43	50				
Santa Fe Energy		119	97				
Seagull Energy		60	42				
Sonat		187	149				
Taylor Energy		20	28				
Transco Coal Methane		50	170				
Transco Exploration		45	50				
Ultramar		40	35				
Union Texas		90	97				
Wainoco		20	20				
Wolverine Exploration Co.		18	28				
CANADA†							
Alberta Energy		121	121				
Amerada Hess		50	40				
Amoco		475	450				
Anderson		51	64				
Bow Valley		64	72				
BP Canada		112	108				
Canadian Occidental		26	26				
Chauvco Resources		43	24				
Chevron		420	350				
Columbia Gas		30	34				
Co-Enerco		22	19				
Dekalb Energy		33	33				
Du Pont		50	60				
Encor Energy		73	69				
Enron		28	27				
Gulf Canada		241	198				
Imperial		420	400				
Kerr-McGee		35	35				
Lasmo		102	42				
Mark Resources		62	72				
Mobil		300	200				
Morgan Hydrocarbons		30	18				
Murphy		27	29				
Noranda		112	132				
Norcen Energy		149	115				
North Canadian		80	66				
Numac		23	24				
PanCanadian		323	271				
PanContinental		18	21				
Poco		63	55				
Ranchmen's Resources		22	18				
Renaissance Energy		138	112				
Saskatchewan Oil & Gas		156	171				
Sceptre Resources		71	45				
Shell Canada		605	365				
Suncor		73	60				
Total Petroleum NA		38	32				
Union Pacific		30	30				
Unocal		85	75				
Voyager Energy		35	32				
Westcoast Petroleum		75	60				
OTHER INTERNATIONAL†							
Amerada Hess		400	310				
Amoco		1,300	950				
Anadarko		20	10				
Aran Energy		20	11				
ARCO		725	625				
BHP		820	550				
Bow Valley		139	99				
Bridge Oil		22	17				
BP		2,800	2,500				
Canadian Occidental		35	35				
Chevron		1,050	850				
Clyde Petroleum		108	98				
Du Pont		930	860				
Elf Aquitaine		2,650	1,900				
Encor Energy		26	30				
Enterprise Oil		1,000	690				
Exxon		2,835	2,700				
Goal Petroleum		33	37				
Gulf Canada		60	60				
Hamilton Oil		250	141				
Kerr-McGee		100	100				
Lasmo		720	435				
Louisiana Land		71	41				
Maxus Energy		125	187				
Mobil		1,100	875				
Murphy		37	18				
Noble Affiliates		25	21				
Nomeco		31	8				
Norcen Energy		53	34				
Occidental		443	465				
Odeco		36	22				
Oryx		160	110				
Petrofina		627	353				
Phillips		318	202				
Premier Consolidated		49	89				
Ranger Oil		149	53				
Royal Dutch/Shell		2,700	2,935				
Saga Petroleum		311	279				
Sovereign Oil & Gas		26	32				
Statoil		1,200	965				
Sun		126	100				
Texaco		950	700				
Total CSB		875	790				
Triton Energy		54	54				
Ultramar		200	190				
Unimar		47	47				
Union Texas		225	244				
Unocal		375	283				
USX		525	350				

*Estimates for both years. †Companies spending at least \$20 million in either year.

Source: Salomon Bros. Inc.

If oil prices averaged only \$20/bbl in 1991, only 19% of the companies surveyed would cut their E&P budgets. If prices averaged \$30/bbl in 1991, 35% of the companies surveyed would increase their budget. As it turned out, the average price didn't even approach that figure.

Canadian companies, which cited cash flow as the most critical determinant of spending, also said they would be more inclined to cut spending at a \$20 price and more inclined to increase spending at a \$30 price, Salomon Bros. survey determined.

WORLDWIDE LOOK AT RESERVES AND PRODUCTION

ESTIMATED PROVED RESERVES					OIL PRODUCTION			
COUNTRY	Jan 1, 1992		Jan 1, 1991		Producing wells* Dec 31, 1990	Estimated 1991 (1,000 b/d)	Change from 1990 (%)	Actual 1990 (1,000 b/d)
	Oil (1,000 bbl)	Gas (bcf)	Oil (1,000 bbl)	Gas (bcf)				
ASIA-PACIFIC								
Afghanistan.....	...	3,530	...	3,530	...	...	...	...
Australia.....	1,523,700	15,057	1,566,163	15,433	1,607	543.0	-5.7	576.0
Bangladesh.....	500	25,600	500	12,700	10	0.9	0.0	0.9
Brunei.....	1,350,000	11,200	1,350,000	11,200	584	151.3	12.7	134.3
China.....	24,000,000	35,400	24,000,000	35,300	49,700	2,800.0	1.2	2,767.6
China, Taiwan.....	4,000	670	4,500	700	93	1.9	-32.1	2.8
India.....	6,126,740	25,772	7,997,100	25,049	2,514	647.0	-2.6	664.6
Indonesia.....	6,581,293	64,837	11,050,000	91,450	7,262	1,432.6	11.1	1,289.0
Japan.....	59,753	968	63,019	1,124	343	14.0	50.5	9.3
Malaysia.....	3,045,000	59,055	2,900,000	56,900	503	629.0	1.0	623.0
Myanmar (Burma).....	50,000	9,350	51,000	9,400	450	12.0	-7.7	13.0
New Zealand.....	170,230	3,449	209,000	4,106	51	40.0	5.3	38.0
Pakistan.....	162,000	22,600	162,087	19,449	97	69.5	12.1	62.0
Papua New Guinea.....	200,000	8,000	200,000	8,000	...	...	...	...
Philippines.....	38,000	100	38,688	1,800	11	3.0	-37.5	4.8
Thailand.....	262,000	13,600	150,000	5,850	299	46.6	10.4	42.2
Viet Nam.....	500,000	100	500,000	100	NA	65.8	119.3	30.0
Total Asia-Pacific.....	44,073,216	299,288	50,242,057	302,091	63,524	6,456.6	3.2	6,257.5
WESTERN EUROPE								
Austria.....	84,984	388	81,443	403	1,242	25.9	19.4	21.7
Denmark.....	755,000	4,059	799,435	4,488	98	140.4	16.3	120.7
France.....	170,836	1,296	184,766	1,324	647	58.5	-4.4	61.2
Germany.....	449,000	8,760	425,000	12,400	2,100	74.3	-3.6	77.1
Greece.....	41,000	44	30,000	47	13	15.3	-6.7	16.4
Ireland.....	...	1,700	...	1,700	...	...	...	...
Italy.....	692,153	11,370	693,503	11,624	222	89.5	-4.8	94.0
Netherlands.....	144,650	69,570	157,200	60,900	187	66.3	-5.7	70.3
Norway.....	7,609,400	60,670	7,609,412	60,674	308	1,864.0	15.0	1,620.5
Spain.....	21,389	740	20,000	780	44	21.3	31.5	16.2
Turkey.....	540,450	705	650,000	1,150	684	86.7	20.1	72.2
United Kingdom.....	3,994,310	19,247	3,825,000	19,775	880	1,779.3	-3.8	1,849.7
Total Western Europe.....	14,503,172	178,549	14,475,759	175,265	6,425	4,221.5	5.0	4,020.0
EASTERN EUROPE & U.S.S.R.								
Albania.....	165,000	670	165,000	700	NA	30.0	-25.0	40.0
Bulgaria.....	15,000	250	15,000	250	NA	4.0	0.0	4.0
Czechoslovakia.....	15,000	490	15,000	490	NA	3.0	0.0	3.0
Hungary.....	158,500	3,758	220,000	4,320	NA	39.0	-2.5	40.0
Poland.....	30,000	4,590	30,000	5,640	NA	2.0	0.0	2.0
Romania.....	1,150,000	3,700	1,170,000	4,700	NA	130.0	-18.8	160.0
U.S.S.R.....	57,000,000	1,750,000	57,000,000	1,800,000	148,900	10,260.0	-9.9	11,390.0
Yugoslavia.....	240,000	2,900	240,000	2,900	1,645	56.3	-11.9	63.9
Total Eastern Europe & U.S.S.R.....	58,773,500	1,766,358	58,855,000	1,819,000	150,545	10,524.3	-10.1	11,702.9
MIDDLE EAST								
Abu Dhabi.....	92,200,000	182,800	92,200,000	182,800	1,001	1,945.8	16.7	1,667.0
Bahrain.....	83,490	6,010	97,460	6,250	317	38.2	-0.3	38.3
Dubai.....	4,000,000	4,600	4,000,000	4,800	150	434.0	3.0	421.4
Iran.....	92,860,000	600,350	92,850,000	600,350	361	3,342.0	2.8	3,252.0
Iraq.....	100,000,000	95,000	100,000,000	95,000	820	280.0	-86.5	2,080.0
Israel.....	1,289	10	1,400	10	12	0.2	0.0	0.2
Jordan.....	5,000	100	20,000	400	4	0.3	0.0	0.3
Kuwait.....	94,000,000	48,000	94,525,000	48,600	363	126.3	-88.3	1,079.0
Neutral Zone.....	5,000,000	1,000	5,000,000	10,000	499	129.7	-58.4	312.0
Oman.....	4,250,000	9,900	4,300,000	7,200	1,237	705.0	4.1	677.0
Qatar.....	3,729,000	162,000	4,500,000	163,200	238	390.0	-1.0	394.0
Ras al Khaimah.....	400,000	1,200	400,000	2,000	7	0.8	0.0	0.8
Saudi Arabia.....	257,842,000	184,048	257,504,000	180,355	1,235	8,157.7	30.4	6,257.6
Sharjah.....	1,500,000	10,700	1,500,000	10,800	20	24.7	-10.5	27.6
Syria.....	1,700,000	6,400	1,700,000	5,500	963	473.0	21.9	388.0
Yemen.....	4,000,000	7,000	4,000,000	7,000	87	200.8	6.1	189.3
Total Middle East.....	661,570,779	1,319,118	662,597,860	1,334,385	7,314	16,348.5	-3.2	16,784.5

COUNTRY	ESTIMATED PROVED RESERVES				OIL PRODUCTION			
	Jan 1, 1992		Jan 1, 1991		Producing wells* Dec 31, 1990	Estimated 1991 (1,000 b/d)	Change from 1990 (%)	Actual 1990 (1,000 b/d)
	Oil (1,000 bbl)	Gas (bcf)	Oil (1,000 bbl)	Gas (bcf)				
AFRICA								
Algeria	9,200,000	116,500	9,200,000	114,700	920	798.0	0.5	794.0
Angola	1,818,173	1,800	2,074,000	1,800	428	493.3	4.8	470.8
Benin	19,900	...	100,000	...	8	4.0	2.6	3.9
Cameroon	400,000	3,880	400,000	3,880	175	151.5	-5.9	161.0
Congo	830,000	2,600	830,000	2,580	327	155.5	0.3	155.0
Egypt	4,500,000	12,400	4,500,000	12,400	907	885.0	1.5	872.0
Equatorial Guinea	...	840	...	840	...	...	...	...
Ethiopia	...	880	...	880	...	...	...	...
Gabon	730,000	450	730,000	490	310	294.7	8.9	270.7
Ghana	500	...	500	...	...	...	...	...
Ivory Coast	100,000	3,500	100,000	3,500	13	2.0	0.0	2.0
Libya	22,800,000	43,000	22,800,000	43,000	712	1,500.0	9.2	1,374.0
Madagascar	...	70	...	70	...	...	...	...
Morocco	2,139	43	2,000	53	12	0.9	0.0	0.9
Mozambique	...	2,290	...	2,290	...	...	...	...
Namibia	...	2,100	...	2,000	...	...	...	...
Nigeria	17,899,820	104,720	17,100,000	87,400	1,574	1,857.3	2.6	1,810.9
Rwanda	...	2,000	...	2,000	...	...	...	...
Somalia	...	210	...	210	...	...	...	...
South Africa	...	1,800	...	1,760	...	...	...	...
Sudan	300,000	3,000	300,000	3,000	...	...	...	...
Tanzania	...	4,100	...	4,100	...	...	...	...
Tunisia	1,700,000	3,000	1,700,000	3,000	159	104.8	13.3	92.5
Zaire	187,000	1,058	55,640	30	121	28.4	-2.4	29.1
Total Africa	60,487,532	310,241	59,892,140	289,983	5,666	6,275.4	4.0	6,036.8
WESTERN HEMISPHERE								
Argentina	1,569,987	20,449	2,280,000	27,000	10,305	487.3	1.2	481.3
Barbados	3,337	6	3,083	6	93	1.2	0.0	1.2
Bolivia	119,000	4,500	119,182	4,149	305	22.3	6.2	21.0
Brazil	2,800,349	4,046	2,840,000	4,045	6,267	635.8	0.4	633.0
Canada	5,587,798	96,734	5,782,949	97,589	39,159	1,523.3	0.3	1,518.0
Chile	300,000	4,100	300,000	4,100	331	17.8	-11.0	20.0
Colombia	1,935,200	3,889	2,000,000	4,500	3,740	439.2	-0.2	440.0
Cuba	100,000	100	100,000	100	NA	15.0	0.0	15.0
Ecuador	1,550,000	3,885	1,420,000	3,950	947	292.8	2.3	286.0
Guatemala	34,797	10	36,205	10	15	3.8	-2.6	3.9
Mexico	51,298,000	71,508	51,983,000	72,744	4,740	2,777.0	4.9	2,648.0
Peru	382,181	7,075	405,937	7,082	3,299	116.2	-11.6	131.4
Suriname	37,600	...	27,300	...	153	4.1	5.1	3.9
Trinidad & Tobago	535,000	8,900	538,000	8,910	3,203	144.9	-3.9	150.8
Venezuela	59,100,000	110,000	59,040,000	105,688	8,425	2,341.3	12.3	2,084.5
United States	26,250,000	169,300	26,177,000	166,208	597,320	7,371.4	0.2	7,355.3
Total Western Hemisphere	151,603,249	504,502	153,050,656	506,081	678,302	16,193.2	2.5	15,793.3
TOTAL WORLD	991,011,448	4,378,056	999,113,472	4,216,685	911,776	59,919.5	-1.1	60,595.0
Total OPEC	769,392,113	1,733,090	773,819,000	1,744,583	24,844	23,347.5	-0.2	23,400.5

EDITOR'S NOTE: All reserves figures except those for the U.S.S.R. (and gas for Canada) are reported as proved reserves recoverable with present technology and prices. U.S.S.R. figures are "explored reserves" which include proved, probable, and some possible. Canadian gas figure, under criteria adopted by Canadian Petroleum Association in 1980, includes proved and some probable. *Does not include shut in, injection, or service wells.

Worldwide Production

• Offshore

(e) Estimated

(c) Condensate

(NA) Not available

WORLDWIDE PRODUCTION

		— No. of wells —		Production		*API gravity		
		Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1990 bbl			
Name of field, discovery date		Depth, ft						
ABU DHABI(e)	ADNOC, OTHERS	Aasb, 1965	8,000-8,700	106	248	40.8		
		Bab, 1958	8,600-9,300	100	232	40.6		
		Bu Hase, 1962	8,300-9,200	201	371	39.0		
		Sahil, 1967	9,500-9,800	22	52	39.7		
		• Umm Shail, 1958	9,800-12,000	142	203	37.0		
		• Zakum Lower, 1963	8,000-9,000	131	254	39.0		
		• Zakum Upper, 1963	7,000-8,000	142	262	35.0		
		• Umm Addalikh, 1969	7,700-8,500	32	54	32.0		
		• Satah, 1975	8,550-9,500	10	21	39.8		
		• Arzanah, 1973	11,000-11,300	14	34	44.6		
		• Abu Al Bukhoosh, 1969	8,900-10,900	42	48	32.0		
		• Mubarratz, 1969	8,300-10,000	28	28	37.0		
		• Bunduq, 1964	9,400-10,900	23	40	40.0		
		Total Abu Dhabi		1,001	1,863	1,667,000	9,999,761,800	
ALGERIA(e)	SONATRACH	Zarzaitine, 1957	4,700			42.2		
		Ecjeleh, 1956	1,500-2,800			37.2		
		Tiguentourine, 1966	2,160-4,265			44.4		
		El Adeb Laneche, 1958	4,100			43.3		
		Assakafal N. & S., 1958	2,800			42.7		
		Tan Emellel N. & S., 1960	2,800-4,500			42.5		
		Edeyen, 1964	5,580			41.5		
		Hassi Mazoula S., 1963	4,430			40.2		
		Hassi Mazoula B., 1965	4,920			42.0		
		Acheb W. & Kneb, 1963 & 1960	7,360			45.6		
		Tin Fouye N. + F6, 1962	4,265			39.6		
		El Borma, 1967	8,200			42.9		
		Keskassa, 1968	8,860			42.9		
		Merekken, 1974	9,420			45.8		
		Gara, 1962	9,420			42.9		
		Hassi Messaoud N., 1956	10,500			45.9		
		Hassi Messaoud S., 1956	10,500			46.1		
		Gassi-Touil & Gassi-Touil E., 1961	6,890			50.6-50.8		
		Hassi Chergui	8,200			50.6		
		Nezle N., 1965	8,530			51.5		
		Rhoude El Baguel, 1962	9,850			40.2		
		Mesder E. & W., 1972	11,155			40.3		
		El Gassi-El Agreb, 1959	10,170	920	920	794,000	8,322,776,000	
		Rhoude Nouse & E., 1972	8,530				39.7	
		Tin Foye Tabankort, 1966	4,600-6,560				41.1-41.3	
		Djoua W., 1967	5,580-6,240				41.1	
		Amassak, 1970	6,565				41.1	
		Tamendjelt, 1970	5,585-6,890				41.1	
		Timedratine, 1964	8,155				42.7	
		Charret N. & S., 1960	7,878				43.8	
		Akarene, 1962	8,200				41.7	
		Guelia, 1962	8,960				41.7	
		Stah, 1971	9,515				45.8	
		Ras Toub, 1976	9,190				35.7	
		Heoud Berkouli-Ben Kahla, 1965	11,000				43.6	
		Guelila-Guelila N.E., 1969	11,320				42.2-42.3	
		N'Goussa, 1974	11,715				42.2	
		Kel El Argoub, 1973	12,570				42.2	
		Oued Noumer, 1969	8,860				48.3	
		Djorf, 1974	9,025				48.3	
		Djebel Onk, 1960	3,940				37.0	
		Alrar FJT	...				...	
		Hassi R'Me(c)	...				...	
		Gassi Touil(c)	...				...	
		Total Algeria		920	920	794,000	8,322,776,000	
ANGOLA	FINA ANGOLA	Benfica, 1955	8,300	1	5	23	2,284,000	30.0
		Bento, 1972	7,350	1	3	207	5,152,000	36.0
		C. Cobra, 1969	4,000	...	11	337	3,791,000	41.0
		Cacuso, 1958	7,870	1	4	15	285,000	30.0
		Galinda, 1959	7,220	...	8	...	2,245,000	30.0
		Ganda, 1975	5,000	9	9	4,720	8,506,000	36.0
		Lagua, 1972	6,300	1	1	102	770,000	31.0
		Luango, 1977	3,800	3	3	937	2,948,000	38.0

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
		Producing	Total	1990 average bbl	Cumulative to Dec. 31, 1990 MM	
Lumueno, 1977	4,800	9	12	2,490	5,612,000	37.0
Mulervos, 1966	5,900-6,600	5	12	196	5,221,000	25.0
NZ Kiona S & D, 1973	5,200-5,670	7	7	2,703	17,965,000	30.4
NZ Pangala, 1973	4,997-5,085	8	13	3,934	49,817,000	36.1
NZombo, 1973	5,000-6,300	11	14	1,808	27,324,000	33.0
Pambo, 1982	4,600	4	5	822	2,439,000	39.0
Pinda, 1966	6,709	...	1	...	3,000	28.0
Quenguela, 1966	6,000	20	32	1,006	38,256,000	31.0
Quintuquena, 1975	6,800-7,100	12	19	3,239	27,428,000	32.0
Quingula, 1972	3,400	20	30	6,979	36,805,000	36.0
Sereia, 1974	6,200	3	4	791	1,737,000	27.0
Tobias, 1961	1,970	1	10	49	28,961,000	31.0
CHEVRON • Kali, 1969	11,400-11,660	1	1	30	4,345,226	30.0
• Kambala, 1971	10,500	4	5	4,967	23,602,197	32.8
• Kungulo, 1975	4,000	16	17	8,984	53,475,618	32.2
• Lituma, 1984	7,800	1	1	81	234,864	31.4
• Limba, 1969	2,660-7,350	13	15	12,105	97,090,800	31.6
• Livuita, 1979	8,000	5	7	370	2,931,500	31.7
• Malongo North, 1966	1,170-9,250	59	73	15,817	26,599,993	30.0
• Malongo South, 1966	1,150-1,440	27	33	7,109	80,403,853	28.0
• Malongo West, 1966	1,680-8,800	20	42	20,115	251,933,141	22.5
• Numbi, 1960	3,446	23	33	53,211	55,763,667	34.0
• Takula, 1971	3,070-9,090	62	73	93,285	269,720,448	31.5
• Vuko, 1983	3,700	8	6	3,521	13,960,233	35.0
• Wamba, 1982	2,700	6	7	23,195	38,610,909	29.0
TEXACO-SOMANGOL-TOTAL-BRASPETRO • Curtala, 1978	7,200	...	1	...	2,265,701	31.0
• Esuango, 1975	6,500	7	10	3,646	23,505,296	35.0
• Lombo Este, 1983	7,800	9	10	26,649	22,935,746	41.0
• Sulele Oeste, 1985	7,600	6	8	3,280	3,639,306	41.0
• Sulele South 1, 1986	7,600	1	2	1,312	1,562,023	39.0
• Tuberillo, 1984	7,800	6	8	11,362	11,855,545	41.0
ELF ANGOLA • Pacassa, 1982	11,500	14	25	62,400	87,637,500	38.0
• Palanca, 1981	8,860	13	21	46,050	89,242,500	40.0
• Biefala, 1982	10,500	6	6	20,800	13,042,500	89.0
• Impute South East, 1985	8,500	7	7	22,200	9,556,750	36.0
Total Angola		428	612	470,879	1,653,486,316	

ARGENTINA

INA	YPF	Chubut, 1907	1,908-9,168	2,357	2,429	84,510		21.1-26.0
		Formosa, 1964	11,466-11,490	13	14	9,483		42.0-42.9
		Jujuy, 1969	2,461-16,732	10	19	735		46.5-47.0
		La Pampa, 1968	3,609-4,921	223	230	9,137		31.0
		Mendoza, 1932	2,178-16,778	1,056	1,092	10,756		23.7-32.0
		Neuquen, 1918	1,312-12,496	1,265	1,348	105,905	4,855,710,000	24.0-41.0
		Rio Negro, 1960	2,953-7,546	981	1,002	7,059		22.5-41.0
		Salta, 1929	6,551-15,092	34	48	6,770		29.0-59.0
		Santa Cruz, 1946	1,468-17,060	3,051	3,149	93,848		21.1-30.0
		Tierra del Fuego, 1959	5,249-7,824	215	220	44,048		43.4-46.0
	AMOCO	Cerro Dragon, 1958	7,200	1,100	1,600	41,058	454,455,459	21.0
OTHER OPERATORS ^(a)		All fields	...	...	...	68,000	24,820,000	...
		Total Argentina		10,305	11,142	481,308	5,334,985,459	

AUSTRALIA

BARRACK ENERGY Mount Homer, 1965	3,900-5,800	7	8	605	440,248	38.0
BHP PETROLEUM PTY. LTD • Challee/Cassini, 1964	5,000	7	7	30,300	11,600,000	39.5
• Jabinu, 1963	4,796	4	4	53,300	55,600,000	42.3
HADSON ENERGY LTD. • Harriet, 1963	6,230	12	12	11,900	19,260,000	38.2
AGL PETROLEUM Alton, 1964	6,000	3	8	28	1,919,391	49.5
Anabranch, 1965	4,188	...	...	...	13,718	44.0
Bennett, 1965	5,960	1	1	5	120,268	45.0
Cabewin, 1961	10,800	1	1	2	62,986	48.0
Maffra, 1965	4,251	1	1	13	42,945	48.0
Mereenie, 1964	4,000	24	37	1,500	5,152,475	48.9
Merit, #1, 1965	4,521	1	1	66	74,358	51.0
Moonie, 1961	5,800	19	38	500	22,286,028	44.5
Richmond, 1963	3,643	1	1	...	16,388	43.0
Snake Creek, 1964	4,990	...	...	...	13,158	67.0
Sunny Bank, 1962	6,139	...	...	...	708	40.0
Trinidad 1 & 3, 1965	4,569	1	1	...	83,594	46.0
EROMANGA ENERGY Blina, 1961	4,300	5	6	222	1,345,850	38.0
Boundary, 1990	3,940	1	1	44	220	31.0
Lloyd, 1967	4,808	1	1	44	144,340	37.0
Sundown, 1963	3,600	2	4	14	196,580	39.0
West Terrace, 1965	3,800	2	2	30	146,920	33.0
WOODSIDE • North Rankin, #1 1972	9,800	20	20	30,000	37,000,000	53.1
COMMAND Dikera, 1969	3,447	1	1	17	5,747	48.0
Fairmount, 1985	6,730	5	6	489	617,003	50.5

PRODUCTION

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells		1990 average b/d	Cumulative to Dec. 31, 1990 bbl	API gravity
			Producing	Total			
	Kihee, 1986	3,200	...	1	...	813	44.7
	Kooru, 1985	4,822	...	1	...	952	41.0
	Maxwell South, 1989	2,822	1	1	62	19,650	47.2
	Maxwell, 1987	2,930	3	3	245	268,960	47.2
	Mindagabie, 1987	5,290	...	1	...	658	40.3
	Muthero, 1989	3,448	1	1	76	36,304	44.4
	Nockatunga, 1983	3,310	3	5	104	373,142	48.0
	Thungo, 1986	3,345	4	4	271	387,982	46.8
	Winna, 1985	3,300	2	2	73	150,728	45.8
ESSO-BHP	• Baracouta, 1965	4,550	7	10	1,140	35,496,000	62.8
	• Bream, 1969	6,290	14	24	30,190	20,260,000	44.0
	• Cobia, 1972	7,700	10	12	23,010	94,456,000	44.6
	• Dolphin, 1967	4,000	1	1	7,640	2,786,000	45.0
	• Flounder, 1968	8,200	19	22	26,640	36,487,000	46.7
	• Fortescue, 1979	7,700	14	28	42,630	206,886,000	43.0
	• Halibut, 1967	7,700	11	16	30,520	733,447,000	43.3
	• Kingfish, 1967	7,500	23	30	37,330	979,933,000	46.9
	• Mackerel, 1969	7,700	14	18	23,250	397,849,000	45.6
	• Marlin, 1966	5,100	18	22	6,700	64,647,000	50.0
	• Perch, 1968	3,700	1	1	9,150	3,341,000	41.0
	• Seahorse, 1978	4,700	1	1	710	280,000	53.0
	• Snapper, 1968	4,350	11	27	6,800	18,681,000	47.0
	• Tanwhine, 1981	4,500	1	1	3,350	1,222,000	58.0
	• Tuna, 1966	6,500	11	18	10,670	41,647,000	40.5
	• West Kingfish, 1968	7,500	16	19	40,120	98,527,000	46.9
	• Whiting, 1983	4,800	4	5	14,800	5,924,000	53.0
MARATHON AUST	• Talisman, 1984	9,800	2	2	4,953	4,484,554	41.0
OIL COMPANY OF AUSTRALIA	Black Stump, 1966	3,815	1	1	50	168,838	45.2
	Bodalla South, 1984	4,780-5,215	6	7	746	4,063,669	47.8
	Bora Creek, 1982	4,900	1	1	2	18,186	34.0
	Cogoon River West, 1980	4,680	...	1	...	...	...
	Kenmore, 1985	4,583-4,988	9	11	1,915	4,652,099	48.2
	Kinross, 1980	4,700	1	1	10	307,058	34.0
	Riverslea, 1981	4,950	2	2	55	374,206	37.0
	Sandy Creek, 1982	4,900	...	1	...	8,730	34.0
	Waratah, 1982	5,350	3	4	40	312,503	34.0
	Washpool, 1985	5,250	1	1	5	3,650	35.0
WESTERN MINING CORP.	• Chervil, 1983	3,380	2	2	2,266	1,300,595	45.0
	• North Herald, 1983	3,837	1	1	1,641	3,482,228	45.0
	• South Pepper, 1983	4,036	6	6	5,741	5,365,015	45.0
BRIDGE OIL LTD.	Boggo Creek, 1980	5,320	...	1	...	3,000	46.0
	Louise, 1986	5,910	1	2	32	106,686	58.0
	Narrows, 1986	5,739	1	1	7	25,439	60.0
	Taylor, 1986	5,538	11	14	768	785,591	47.0
	Thornby Creek, 1979	5,170	...	3	...	54,000	50.0
	Waggamba, 1978	7,670	1	1	12	20,962	55.0
	Yellowbank Creek, 1982	5,180	1	2	23	372,817	52.0
AMPOLEX (PPL) PTY. LTD. (a)	Cranstoun, 1987	4,250	1	1	...	...	48.0
	Endeavour, 1989	5,085	1	1	...	...	49.7
	Ipundu, 1986	2,700	1	1	...	...	43.0
	Ipundu, North, 1989	4,354	1	1	...	...	46.7
	Monter, 1987	4,150	2	2	...	...	49.0
	Talgaberry, 1985	3,800	2	3	...	...	46.0
	Talysah, 1985	3,800	1	1	...	...	43.0
	Tarbat, 1989	2,700	1	1	...	...	43.0
	Tintaburna, 1984	3,500	5	6	...	...	43.0
	Tooburnyah, 1985	3,500	4	5	...	...	43.0
SANTOS LTD. (a)	Aheyn, 1985	5,200	2	2	...	...	41.0
	Big Lake, 1984	6,800	2	3	...	...	45.0-48.0
	Bogala, 1984	6,800	2	2	...	...	40.0
	Bookabourdie, 1985	7,000	2	2	...	...	46.0
	Broiga, 1983	9,547	1	1	...	...	53.0
	Challum, 1983	...	...	1	...	...	...
	Chookoo, 1985	6,000	4	8	...	...	45.0
	Cook, 1985	...	...	1	...	...	...
	Coralla, 1989	...	1	1	...	...	...
	Cooroo/Cooroo North, 1985	...	4	5	...	...	...
	Dingers, 1987	...	...	1	...	...	...
	Dinkala, 1986	7,000	1	1	...	...	56.0
	Duffingi, 1979	5,200	15	31	...	...	54.0
	Fly Lake, 1971	9,300	1	3	...	...	53.0
	Giddeelpa, 1984	9,180	13	13	...	...	45.0-50.0
	Giddee, 1989	...	1	1	...	...	...
	Gurna, 1983	6,000	1	1	...	...	40.0
	James, 1989	...	1	1	...	...	...
	Jackson, 1981	4,780	35	38	...	...	40.0-48.0
	Jackson South, 1982	4,800	5	8	...	...	40.0
	Jena, 1985	5,200	4	4	...	...	41.0
	Kerourunrun, 1985	...	...	1	...	...	50.8
	Kerina, 1984	4,300	...	1	...	...	41.0

PRODUCTION

WORLDWIDE PRODUCTION

			— No. of wells —		Production		API gravity	
Name of field, discovery date		Depth, ft	Producing	Total	1990 average b/d	Cumulative to Dec. 31, 1990 bbl		
	Limestone Creek/Biala, 1984.....	5,100	10	11			41.0	
	Mawson, 1987.....	...	1	1			...	
	McKinlay, 1985.....	5,100	1	2			41.0	
	Merapi, 1985.....	5,660	3	3			1.0	
	Merrimella, 1983.....	5,250-7,070	10	11			5.5	
	Moolampah, 1985.....	6,000	2	2			...	
	Moonari, 1971.....	7,705-9,400	6	6			6.9	
	Munro, 1988.....	...	2	2	113,574	383,271,834	...	
	Muteroo, 1985.....	6,000	5	5			5.0	
	Naccowiah, 1989.....	...	1	1			...	
	Naccowiah East, 1988.....	...	1	1			...	
	Naccowiah South, 1983.....	6,000	9	10			...	
	Naccowiah West, 1983.....	5,700	9	9			...	
	Narconowia, 1983.....	6,000	2	2			...	
	Natan.....	...	1	1			...	
	Nungaroo, 1985.....	4,150	1	1			...	
	Pinaroo, 1989.....	...	1	1			...	
	Pintari North, 1988.....	...	1	1			...	
	Pitchery, 1988.....	...	1	1			...	
	Sigma, 1983.....	5,700	2	2			...	
	Spencer, 1986.....	6,500	6	6			7.0	
	Strzelecki, 1978.....	5,800	15	17			...	
	Sturt, 1988.....	...	4	4			...	
	Sturt East.....	...	4	4			...	
	Taloola, 1988.....	...	2	2			...	
	Tantanna, 1988.....	...	4	4			...	
	Tickalara, 1984.....	5,600	5	5			...	
	Timpila, 1983.....	6,000	1	1			...	
	Timawarra, 1970.....	9,500	29	40			2.0	
	Toby, 1987.....	...	...	1			...	
	Ulandi, 1985.....	5,200	3	3			0.4	
	Wandloo, 1989.....	...	2	2			...	
	Wandoocha, 1984.....	6,000	3	6			54.0	
	Watson, 1985.....	...	2	2			...	
	Watson South, 1985.....	5,500	2	2			40.0	
	Wilson, 1983.....	5,000	5	6			...	
	Woolkina, 1982.....	9,700	1	2			...	
	Yanda, 1984.....	8,000	1	1			...	
WAPET GROUP ^(a)	Barrow Island, 1964.....	1,200-6,700	412	539			37.7	
	Dongara, 1969.....	5,250-5,577	1	9			35.5	
	Theravard Island, 1985.....	4,800-5,750	7	7			48.2	
STRATA OIL ^(a)	Woodada, 1980.....	7,400	...	...			54.0	
Total Australia.....			1,050	1,388	576,000	3,308,380,552		
AUSTRIA	MOBIL/SHELL	Gaiselberg, 1938.....	5,200	33	63	675	32,896,048	25.0
		Kemating, 1979.....	6,100	7	9	578	4,458,284	34.0
		Sattledt, 1971.....	5,700	11	19	528	5,642,300	37.0
		Other.....	...	55	153	1,376	47,429,636	33.0
	OEMV	Hochleiten, 1977.....	3,100-5,000	29	45	1,012	2,245,614	21.3
		Matzen, 1949.....	6,100	736	904	10,754	393,242,308	25.7
		Muehlberg, 1942.....	3,900-5,500	36	48	262	40,722,889	35.0
		Piperbach, 1968.....	3,500	7	8	162	4,106,580	39.0
		Pirawarth, 1957.....	1,800-6,500	56	65	1,059	13,387,250	28.4
		Schoenkirchen-Proflus Tief, 1962.....	7,800-10,100	14	20	3,577	81,238,735	31.1
		St. Ulrich, 1938.....	1,800-4,300	85	167	691	43,614,185	31.1
Total Austria.....			1,342	1,851	21,722	987,291,586		
BAHRAIN	BAHOCO	Awali, 1932.....	1,850-4,800	317	368	38,276	827,570,740	33.0
Total Bahrain.....			317	368	38,276	827,570,740	33.0	
BARBADOS	BARB. NOC	Woodbourne, 1966.....	1,665-6,701	93	156	1,245	5,961,102	27.2
Total Barbados.....			93	156	1,245	5,961,102	27.2	
BENIN	PROJET PÉTROLIER DE SÈMÉ	Seme, 1968.....	6,232	8	9	3,878	15,184,085	22.8
Total Benin.....			8	9	3,878	15,184,085		
BOLIVIA	YPFB	Caugus, 1973.....	3,280	...	...	...	6,194,981	45.0
		Cambelli, 1976.....	5,787	6	6	97	1,038,616	48.0
		Carni, 1927.....	3,936	42	50	332	48,708,280	55.0
		Caranda, 1980.....	13,032	...	...	...	54,399,820	60.0
		Cascabel, 1985.....	11,319	2	2	369	364,103	45.6
		Colpa, 1962.....	9,184	...	...	...	18,284,329	66.0
		Espero, 1979.....	14,655	...	...	...	966,307	58.2
		H. Suarez R., 1982.....	7,820	3	3	375	623,436	35.0
		La Pena, 1985.....	8,856	30	41	4,346	30,205,438	43.0
		Montesquedo, 1967.....	4,502	22	24	1,086	32,977,717	41.0

PRODUCTION

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells		1980 average b/d	Cumulative to Dec. 31, 1980 bbl	API gravity
			Producing	Total			
	Naranjos, 1964	4,806	14	14	112	133,505	65.3
	Palmar, 1964	10,758	2	4	71	1,772,143	65.0
	Rio Grande, 1962	9,512	35	44	1,828	62,053,852	62.0
	San Roque, 1981	7,170	13	14	2,651	2,317,666	71.0
	Santa Cruz, 1965	9,350	8	9	340	1,863,301	65.0
	Sirani, 1985	13,999	5	5	943	657,814	65.3
	Tatarenda, 1964	2,296	9	12	159	7,513,246	51.0
	Tita, 1976	6,450	5	5	77	4,436,605	67.9
	Vibora, 1986	12,949	5	5	880	649,632	57.7
	Villemontes, 1987	9,770	2	3	212	632,212	57.0
	Vuelta Grande, 1978	8,220	18	18	2,729	4,269,758	67.0
	Other	...	26	38	605	16,772,221	...
PLUS PETROL	Bernabe, 1924	2,085	15	30	6	2,260	42.0
SOL PETROL	Buena Vista, 1956	4,881	1	1	25	12,347	45.8
	Cametindi, 1929	4,110	3	3	101	43,684	42.4
	Caigua, 1973	3,280	1	1	1	296	42.4
PEREZ	Caranda, 1980	13,032	37	45	346	126,367	60.0
	Colpa, 1962	9,184	18	19	316	114,786	65.0
OCCIDENTAL	Porvenir, 1978	9,600	10	10	1,565	12,553,382	60.5
TESORO BOLIVIA PETROLEUM CO.	Escondido, 1980	11,293	5	6	16	5,922	60.0
	La Vertiente, 1977	15,230	6	7	920	5,145,532	50.0
	Los Suns, 1981	13,577	1	1	...	...	50.0
	Taquati, 1981	10,174	2	2	625	317,770	63.0
	Total Bolivia		343	416	20,918	315,075,607	

BRAZIL (*)

ALAGOAS	Furado, 1969	4,440-5,500	51	68			35.0
	• Meio, 1974	6,500-7,400	...	...			35.0
	Pilar, 1981	4,100-5,100	56	62			40.0
	Tabuleiro de Martins, 1957	3,900-4,950	28	29			27.0
	Other	...	18	27			...
AMAZONAS	Igarape Cuiá, 1985	3,600-3,700	...	...			41.0
	Rio Unicu, 1986	7,500-8,300	13	13			44.0
BAHIA	Agua Grande, 1951	820-4,265	113	124			40.0
	Aracas, 1965	3,280-8,856	149	181			41.0
	Buracica, 1959	1,476-1,840	171	190			35.0
	Candeias, 1941	3,280-7,415	36	39			30.0
	• Candeias Mar, 1941	3,300-7,400	17	17			30.0
	Cassaroncongong, 1959	1,475-4,755	153	159			32.0
	Cexis, 1983	1,670-5,230	34	34			30.0
	• Dom Joao Mar, 1947	920-3,000	219	289			38.0
	Dom Joao Terra, 1947	920-1,350	57	94			36.0
	Faz. Alvorada, 1963	2,100-4,900	80	80			31.0
	Faz. Balsamo, 1983	2,500-4,000	114	118			31.0
	Faz. Bos Esperanca, 1966	7,215-8,036	21	23			39.0
	Faz. Imbe, 1964	2,130-5,575	59	78			40.0
	Faz. Panelas, 1962	2,400-5,100	14	27			37.0
	• Bhius, 1979	1,500	...	...			41.0
	Malombé, 1966	3,280	9	15			41.0
	Mata Ramansa, 1971	4,445-4,560	63	76			35.0
	Miranga, 1965	3,280-3,936	227	322			40.0
	Riacho da Barra, 1982	2,910-3,998	51	63			39.0
	Rio Dois Ocos, 1979	2,410-3,750	10	10			35.0
	Rio Pojuca, 1982	5,600-6,200	29	42			35.0
	Rio do Bu, 1964	2,900-3,000	50	50			33.0
	Saritana, 1962	2,400-4,000	5	6			37.0
	Sesmaria, 1963	3,100-4,600	26	26			40.0
	Taquipe, 1958	3,115-3,935	109	138			40.0
	Other	...	150	239			...
CEARÁ	• Alim, 1983	5,800-6,750	20	22			25.0
	• Curima, 1978	6,888	15	17			32.0
	• Espada, 1983	5,750-6,900	6	6			26.0
	Faz. Belem, 1980	1,150-2,500	281	567			13.0
	• Xarau, 1977	5,717-5,766	25	27			38.0
ESPÍRITO SANTO	• Cacao, 1978	5,184	7	12			32.0
	Faz. Cedro, 1962	5,248	11	14			28.0
	Lagoa Parda, 1977	5,576	49	50			30.0
	Lagoa Piabenta, 1984	5,500	2	2			27.0
	Lagoa Surucua, 1982	5,400	22	26			30.0
	Rio Raunias, 1977	5,400	40	40			28.0
	Rio Preto-Oeste/Sul, 1976	...	37	37			...
	Sao Mateus, 1969	5,750	45	53			27.0
	Other	...	125	125			...
RIO DE JANEIRO	• Alibon, 1984	8,430	7	12			26.0
	• Anequim, 1981	8,200-8,500	2	2			27.0
	• Area RJS-150, 1983	7,300	...	...			26.0
	• Area RJS-236 Triha, 1983	8,800-11,000	3	3			28.0
	• Area RJS-387, 1987	11,300	3	3			34.0
	• Badojo, 1981	8,900-10,500	5	6	633,000	2,987,988,940	28.0

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
		Producing	Total	1980 average bbl	Cumulative to Dec. 31, 1980 bbl	
• Bagra, 1983	8,700-9,000	7	9			25.0
• Bico do, 1982	8,000-11,000	11	13			22.0
• Bonito, 1977	6,950-8,000	11	17			27.0
• Carapeba, 1982	10,100	29	36			23.0
• Cheme, 1982	9,900-10,200	29	41			27.0
• Corvina, 1983	9,000-11,000	5	8			25.0
• Enchova, 1976	6,973-7,885	4	24			23.0
• Garoupa, 1974	11,362	19	20			30.0
• Garupinha, 1974	12,893	3	3			30.0
• Linguado, 1981	9,000-11,000	11	18			26.0
• Marimba, 1983	8,900-9,200	5	5			22.0
• Moreira, 1984	8,200-9,500	5	6			28.0
• Namorado, 1975	10,083	27	45			21.0
• Pampo, 1977	6,215	24	31			36.0
• Parati, 1982	8,900-9,200	1	1			20.0
• Pargo, 1975	11,840	16	21			27.0
• Pirauna, 1982	8,000-10,500	7	8			30.0
• Sul de Pampo, 1978	9,300-9,600	...	...			24.0
• Vermelho, 1983	11,200	45	62			13.0
• Viola, 1981	9,200-9,900	8	8			33.0
RIO GRANDE DO NORTE						
• Agulha, 1975	5,412	5	6			18.0
• Alto do Rodrigues, 1981	990-1,120	290	292			32.0
• Area 1-RNS-36, 1982	...	...	...			25.0
• Canto do Amaro, 1986	2,500-3,000	470	486			16.0
• Estrela/Rio Paron, 1983	850- 820	447	447			35.0
• Faz. Poço, 1982	1,450-2,000	174	174			25.0
• Guamaré, 1983	1,400-1,600	30	33			41.0
• Livramento, 1986	2,500-3,300	30	30			28.0
• Lorena, 1984	1,200-1,700	12	12			31.0
• Macau-Mar, 1986	3,000	5	5			31.0
• Macau/Terra, 1982	3,000-3,300	3	2			25.0
• Palmeiras, 1982	1,450-1,800	...	...			27.0
• Serraria, 1982	3,200-3,900	38	38			40.0
• Ubarana, 1973	7,218-8,365	77	92			28.0
• Upanema, 1985	1,110-1,800	15	18			...
• Other	...	118	119			41.0
PARÁ						
• Area 1-PAS-11, 1983	...	...	...			40.0
MARANHÃO						
• São João, 1983	4,950-6,200	...	...			24.0
SERGIPE						
• Atalaia Sul, 1981	1,450	2	3			26.0
• Brejo Grande, 1967	1,870	12	12			36.0
• Caioba, 1989	6,232-6,890	10	14			25.0
• Camurim, 1970	6,232	61	62			24.0
• Carmópolis, 1983	2,460	852	1,008			36.0
• Dourado, 1970	3,620-3,635	4	4			41.0
• Guaranema, 1986	3,335-4,430	13	16			28.0
• Riachuelo, 1981	1,475	235	318			30.0
• Robalo, 1973	3,300-4,500	...	...			30.0
• Sinizinho, 1967	1,540	177	280			...
• Other	...	84	85			
Total Brazil		6,367	7,574	633,080	2,867,899,940	
BRUNEI						
SHELL						
• Ampe SW, 1983	7,088-8,155	105	222	52,087	562,000,000	41.0
• Champion, 1970	4,300	136	245	37,092	327,000,000	23.0
• Fairley, 1969	10,740	41	54	11,844	119,500,000	40.0
• Fairley-Baram, 1973	9,500	4	5	...	12,400,000	40.0
• Magpie, 1975	...	13	23	15,643	86,000,000	31.0
• Nassau, 1929	...	8	20	2,176	6,300,000	30.0
• Sena-Total, 1929	...	275	562	15,423	994,000,000	34.0
Total Brunei		584	1,131	134,288	2,108,100,000	
CAMEROON (a)						
ELF						
• Betika, 1972	5,300					42.5
• Ekoundou S., 1975	6,200					24.0
• Kola, 1974	5,500					31.0
• Kombo Center, 1978	5,800					37.0
• Kombo North, 1978	7,200					26.0
• Ekoundou Hont plus Center, 1972	7,200					29.0
• Boe, 1978	5,900					35.0
• Bayo South, 1978	5,800					29.3
• Betika S. Marine, 1979	6,300	175	179	181,000	540,288,900	30.0
• Ekoundou N. Marine, 1977	6,250					36.0
• Mokoko NE plus Abana, 1977	4,800					29.0
• Asoma Marine, 1973	3,600					19.0
• Kita E. Marine, 1978	6,900					40.8
• Mokoko S. Marine, 1977	3,300					17.0
• Inova Marine, 1978	6,300					32.8
TOTAL-ELF						
• Mouli, 1979	5,250-5,900					40.0
• Mouli D., 1980	3,300					21.3
Total Cameroon		175	179	181,000	540,288,900	

PRODUCTION

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, R	— No. of wells —		Production		*API gravity	
				Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl		
CANADA		ALBERTA	Pembina, 1953	3,000-6,133	3,363	4,278	90,310	1,310,782,087	32.0-37.0
			Redwater, 1956	2,012-3,200	566	883	11,338	796,234,221	35.0
			Swan Hills, 1957	8,100	526	836	36,748	708,688,748	40.0
			Rainbow, 1965	4,994-6,160	272	379	37,761	543,104,399	38.0-42.0
			Bonnie Glen, 1952	3,959-6,779	115	167	8,251	510,178,088	34.0-44.0
			Judy Creek, 1951	6,307-8,701	189	268	18,342	409,254,295	43.0
			Leduc-Woodbend, 1947	3,062-5,386	137	697	2,467	379,051,684	40.0
			Swan Hills S., 1959	8,800	163	201	11,504	353,776,546	...
			Wizard Lake, 1951	4,044-5,973	43	47	7,048	328,425,732	...
			Fann-Big Valley, 1950	3,900-5,400	109	235	3,891	319,092,568	32.0
			Misue, 1964	5,908	291	413	31,977	305,507,520	43.0
			Nipist, 1965	5,648-5,726	264	365	28,070	295,332,578	41.0
			Golden Spike, 1949	3,570-5,981	64	85	2,033	183,242,716	38.0
			Virginia Hills, 1957	9,210	149	196	17,350	159,981,121	34.0
			Sturgeon Lake S., 1953	4,912-8,471	86	146	12,811	152,308,337	...
			Carson Creek N., 1958	8,787-8,935	36	62	7,008	145,968,731	44.0
			Turner Valley, 1913	3,100-9,150	114	156	2,596	141,816,752	38.0
			Westeros, 1952	6,818	31	44	7,280	136,625,134	...
			Acheson, 1950	3,390	55	116	5,440	134,165,880	38.0
			Willaden Green, 1956	5,157	502	827	7,249	122,878,988	...
			Provost, 1946	2,760-2,898	1,759	2,243	48,932	112,742,433	...
			Keybob, 1957	4,870-9,577	66	97	7,358	107,314,832	...
			Grand Forks	...	396	498	23,596	196,930,336	...
			Jornam, 1949	3,179	178	272	6,439	106,824,297	...
			Joffre, 1953	4,943-6,779	97	186	3,547	85,934,658	...
			Keybob S., 1958	5,800-10,042	70	98	7,730	85,195,161	...
			Zama, 1966	3,702	114	236	6,033	80,228,356	33.0-37.0
			Medicine River, 1954	5,435-7,600	243	368	9,777	78,654,937	...
			Innisfail, 1956	6,730-8,440	30	69	3,729	78,043,471	...
			Harmattan East, 1954	6,358-8,768	108	146	4,054	75,617,721	...
			Wainwright, 1925	1,903-2,200	608	752	8,909	75,610,522	...
			Belshill Lake, 1955	2,950	413	480	10,451	71,308,502	...
			Rainbow South, 1965	6,102-6,400	47	80	5,775	68,549,575	...
			Countess, 1951	2,858-4,272	147	192	6,399	68,389,280	...
			Harmattan Eldon, 1955	8,796-10,757	61	83	4,385	66,094,248	...
			Bentley, 1940	2,574-3,300	189	239	10,571	56,600,025	...
			Snake Lake, 1962	6,500	36	92	3,230	56,456,755	...
			Ulkuma Lake, 1963	5,624	113	138	11,072	56,281,474	...
			Clive, 1951	6,074-6,208	126	193	4,844	54,714,329	...
			Lloydminster, 1933	1,880-1,945	104	114	5,015	53,055,037	...
			Gilby, 1962	4,301-7,000	89	158	2,939	49,583,664	...
			Caroline	...	198	291	6,968	43,354,796	...
			Red Earth	4,184-4,878	187	289	4,631	41,420,766	...
			Simoneite, 1958	10,500	32	46	2,151	36,767,862	...
			Westpen	...	11	13	12,616	35,371,839	...
			Cassford, 1950	2,800-3,028	186	303	2,582	32,954,628	...
			Taber N., 1968	3,110-3,270	87	129	6,257	19,257,303	...
			Payter, 1958	2,030-2,515	313	428	7,486	18,097,642	...
			Vehalia, 1973	1,815-7,060	253	306	8,562	16,845,889	...
			Other	...	8,882	14,022	318,973	1,711,303,423	...
		BRITISH COLUMBIA	Boundary Lake, 1957	3,418-4,575	277	358	9,055	178,555,258	40.0
			Eagle West, 1976	2,170-3,940	50	95	4,998	30,906,880	...
			Other	...	377	825	19,252	247,370,880	...
		MANTOBA	All fields	...	1,363	1,581	12,720	175,313,763	...
		SASKATCHEWAN	Weyburn, 1955	4,800	821	895	16,867	299,436,322	...
			Steelman, 1950	...	646	731	7,615	261,231,030	...
			Other	...	12,199	16,939	185,154	1,846,634,888	...
		ONTARIO	All fields	...	1,081	1,588	4,251	68,333,969	...
		NEW BRUNSWICK	All fields	...	...	...	...	805,261	...
		NORTHWEST TERRITORIES	All fields	...	159	164	31,740	88,962,306	...
		Total Canada*			26,188	98,088	1,394,127	15,184,338,088	
CHILE		ENAP	Gaviota Norte, 1980	7,000	3	3	335	122,308	38.0
		ENAP-MAINLAND	Canadon, 1962	6,080	8	62	99	14,658,419	38.4
			Daniel, 1980	5,808	11	121	238	34,545,428	25.4
			Daniel Este, 1981	5,523	8	68	388	28,633,638	25.0
			Delgado Este, 1958	7,694	11	31	170	4,897,084	35.0
			Dungenes, 1962	5,251	3	19	141	4,132,300	28.6
			Faro Este, 1959	7,381	4	32	132	3,416,798	36.0
			Proseon, 1960	5,622	36	76	706	21,942,848	63.6
			Other	...	13	118	1,746	18,243,028	...
		TIERRA DEL FUEGO	Celastria, 1965	6,045	14	61	563	28,323,717	49.3
			Celastria, 1958	5,756	8	28	223	8,886,621	38.7
			Celastria Sur, 1981	5,779	1	43	14	8,390,088	44.0
			Chenarollo, 1961	7,404	2	17	48	7,258,121	58.2
			Cullen, 1954	5,730	12	106	319	41,346,440	41.8
			Gornon, 1988	6,025	6	10	486	1,187,718	39.0
			San Sebastian Norte, 1988	6,870	2	4	34	180,792	37.0

*Does not include oil sands production or wells.

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		1980 average b/d	Cumulative to Dec. 31, 1980 bbl	API gravity
		Producing	Total			
Sombrero, 1951.....	7,126	2	23	4	13,110,418	40.2
Tres Lagos, 1957.....	5,734	18	84	418	16,300,532	40.1
Victoria Sur, 1950.....	7,431	3	34	53	7,866,085	41.1
Other.....	...	37	254	1,125	31,789,388	...
STRAIT OF MAGELLAN						
Daniel Este-Dungeness, 1977.....	6,126	18	36	1,142	5,102,249	35.9
Jaiba, 1978.....	6,650	...	3	34	326,576	46.5
Oslon, 1977.....	7,156	12	13	580	6,518,539	33.0
Pajemey, 1964.....	7,229	19	67	712	10,219,611	39.0
Poseidon, 1977.....	6,727	15	36	489	5,734,362	34.5
Skua, 1968.....	5,932	25	39	3,230	4,144,467	32.0
Spiteful, 1977.....	6,298	30	82	2,307	44,376,313	34.5
Spiteful Norte, 1978.....	7,150	10	32	378	6,799,172	39.0
Total Chile.....		331	1,511	18,042	375,486,671	

CHINA^(*)

CNPC	Daqing, 1959.....	...	...	1,115,448	...	...
	Shengli, 1962.....	...	...	671,836	...	...
	Huabei.....	...	...	107,293	...	...
	Liaohe, 1964.....	...	...	272,745	...	...
	Xinjiang.....	...	...	136,373	...	...
	Dagang, 1964.....	...	...	76,810	...	...
	Henan.....	...	...	50,536	...	...
	Zhongyuan, 1981.....	...	...	126,345	...	...
	Jilin, 1978.....	49,700	49,700	71,195	15,710,087,000	...
	Chengqing.....	...	...	29,290	...	...
	Hanjiang.....	...	...	7,621	...	...
	Yumen.....	...	...	10,830	...	...
	Jiangsu.....	...	...	17,047	...	...
	Qinghai.....	...	...	16,044	...	...
	Sichuan.....	...	...	2,607	...	...
	Jidong.....	...	...	7,019	...	...
	Croco.....	...	...	25,289	...	...
	Other.....	...	...	23,264	...	...
Total China.....		49,700	49,700	2,787,584	15,710,087,000	

CHINA, TAIWAN

CHINESE PETROLEUM	Chingtsu & CBK ^(*) , 1967.....	...	7	25	1,588	3,806,165	50.0
	Chinshu & Yunghoshan ^(*) , 1971.....	...	23	36	265	3,441,228	45.0
	Chuhuangkang ^(*) , 1904.....	...	30	32	182	2,838,361	50.0
	Tsichengshan ^(*) , 1962.....	...	24	31	779	18,112,406	51.0
	Other ^(*)	...	9	10	5	45,213	
	Total China, Taiwan.....		93	136	2,790	26,944,373	

COLOMBIA

ARGOSY^(*)	Bourdine, 1974.....	11,000	2	4	...	26.7
	Méxime, 1976.....	11,000	1	1	...	11.0
	Nancy, 1974.....	11,000	1	1	...	28.0
HOCOL SA (SHELL)^(*)	Palo grande, 1971.....	6,500	32	36	...	20.0
	Pipao, 1981.....	7,000	6	7	...	21.0
	San Francisco, 1985.....	2,800	41	41	...	27.0
	Hato Nuevo, 1984.....	6,900	2	4	...	36.0
	Tenay, 1985.....	11,500	3	3	...	36.3
	Santa Clara, 1987.....	2,100	5	6	...	19.0
	La Jagua, 1986.....	5,300	2	2	...	22.0
	Loma Larga, 1985.....	3,500	1	1	...	22.4
	Braas, 1973.....	4,200	4	6	...	23.5
	Dina T, 1962.....	3,600	51	64	...	20.0
	Dina K, 1968.....	6,500	22	26	...	22.0
	La Canada, 1968.....	700	5	7	...	22.0
	Telo, 1972.....	7,500	36	34	...	22.0
	Cebu, 1981.....	6,500	8	10	...	19.0
SCOPETROL^(*)	Apay, 1981.....	10,600	13	15	...	23.0
	Apay Este, 1987.....	10,300	1	1	...	16.0
	Biquete, 1982.....	8,100	9	24	...	43.0
	Cajapi/Ermitaño, 1964, 1967.....	3,600	3	19	...	15.0
	Campo Yuca, 1958.....	...	1	4	...	32.0
	Canigallo/Yanguí, 1943, 1955.....	6,900-8,700	68	92	...	20.0
	Carbonera, 1939.....	...	4	8	...	32.0
	Caribe, 1970.....	5,400	3	4	...	31.0
	Casibá, 1940.....	3,800	909	1,039	...	19.0-22.0
	Churuyacu/Sucombiac, 1967, 1969.....	...	6	7	...	31.0
	Ciudad, 1948.....	8,600	8	28	...	41.0
	Colorado, 1925.....	...	45	78	...	34.0
	Galen/San Silvestre, 1943.....	3,200	53	102	...	18.0
	Gerzas, 1957.....	...	1	2	148,048	2,218,546,000
	Guatiquia, 1985.....	10,700	3	2	...	20.0
	Hormiga, 1982.....	10,300	2	3	...	29.0
	Intensas, 1918.....	3,200	306	588	...	28.0
	La Cira, 1918.....	3,250	707	951	...	23.0
	La Cristalina, 1950.....	10,000	1	6	...	30.0
	Llenito/Gale/Yuma/Caraleón, 1958, 1965, 1969, 1989.....	7,300	80	97	...	18.0-25.0

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		*API gravity
		Producing	Total	1990 average b/d	Cumulative to Dec. 31, 1990 bbl	
Lisama/Numa/Tesoro Petrolas, 1936, 1966, 1977	9,500	145	219			28.0-32.0
Loro, 1967	10,300	7	12			30.0
Orto, 1946	600-5,200	51	104			25.0-35.0
Ortega, 1951	6,500	5	15			28.0
Palagua, 1954	3,500	96	186			15.0
Peñas Blancas, 1957	...	6	7			23.0
Petrolas, 1933	1,200	5	34			46.0
Puerto Barco, 1956	...	...	4			50.0-60.0
Puerto Colon, 1967	9,600	7	10			29.0
Quili, 1986	...	2	3			21.0
Rio de Oro, 1933	1,800-8,500	20	54			32.0-43.0
San Antonio (S. Miguel), 1967	7,820	2	4			28.0
Sardinata Norte/Sur, 1938, 1942	900-4,100	14	30			30.0-52.0
Sucio, 1971	5,500	1	2			31.0
Surta, 1985	10,500	7	8			35.0
Tibu, 1939	4,500-9,300	250	508			32.0-45.0
Toldado, 1987	6,200	6	7			20.0
Other	...	7	71			...
Agua Blanca, 1962	...	4	7			20.0
Barrancas Lebrja, 1953	8,000	2	11			25.0
Pevas, 1981	...	1	1			21.0
San Luis, Totomai, 1927, 1950	...	2	7			24.0-35.0
Sogamoso, 1958	...	2	4			29.0
Tenerife, 1967	...	1	3			18.0
ESSO COLOMBIANA LTD.						
Arauca, 1980	15,000	3	4	1,443	6,440,075	40.0
Bonanza, 1963	4,000	18	18	677	13,493,912	27.0
Provincia, 1962	8,000	134	172	14,431	172,231,487	29.0
Sabana, 1980	14,000	3	3	259	198,330	29.0
ELF AQUITAINE						
Barquerena, 1962	9,300	3	3	888	3,850,549	33.5
Caño Garza, 1979	7,900	5	5	4,308	3,896,246	33.0
Caño Garza Norte, 1983	7,900	2	2	917	2,343,806	38.5
Cravo Este, 1987	11,376	...	1	...	108,833	42.0
Cravo Sur, 1982	10,600	2	2	1,490	3,469,581	36.0
La Gloria, 1980	14,000	3	3	1,981	723,178	17.8
Gloria Norte, 1983	12,100	3	3	5,078	3,458,586	18.0
Monchal, 1984	15,500	1	1	1,586	678,332	30.0
Tierra Blanca, 1987	14,493	1	1	736	398,967	32.0
Tocaria, 1980	13,500	2	3	1,273	1,844,521	32.2
Trinidad, 1974	9,000	4	4	8,182	7,347,045	33.0
OCCIDENTAL						
Caño Limón, 1984	7,600	9	9	28,720	52,116,006	29.0
Cano Yarumal, 1987	7,600	3	4	23,516	13,213,576	29.0
La Yuca, 1984	7,600	34	36	122,339	194,466,422	29.4
Mateneira, 1984	7,600	10	14	24,803	47,664,549	29.7
Redondo, 1984	7,600	4	5	8,574	9,127,491	30.2
TEXACO						
Cocomá, 1963	2,100	45	54	1,885	15,228,678	12.0-13.0
Taquama, 1963	8,000	5	5	404	5,126,933	18.0-28.0
Velasquez, 1946	7,500	89	100	2,917	168,307,134	19.0-24.0
TEXACO-ECOPETROL						
Los Angeles, 1983	6,400	3	4	538	981,199	14.0-15.0
Nare, 1981	2,100	49	49	3,062	2,048,527	11.0-12.0
Santa Lucia, 1988	9,600	...	3	28	10,159	11.7-26.1
Teca, 1981	2,100	226	238	13,818	35,017,883	12.0-13.0
CHEVRON						
Castilla, 1969	6,500	17	19	13,409	34,324,198	13.5
Cuchimena, 1969	6,500	1	2	1,112	1,176,084	21.3
LASMO						
Santiago, 1985	9,600	5	5	5,580	4,102,981	29.0
Total Colombia		3,740	5,387	440,000	3,021,340,279	

CONGO

AGIP	• Loango, 1972	3,000	52	53	18,150	103,028,300	25.6
	• Zakchi, 1980	2,000	12	12	7,150	5,457,600	24.7
ELF CONGO	• Bind, 1982	4,400	1	1	30	153,211	34.2
	• Emeraude, 1989	800	94	101	17,400	181,916,132	22.3
	• Kuri, 1980	4,000	2	2	130	581,854	35.8
	• Likouala, 1972	4,270	27	41	14,400	66,348,251	32.3
	• Mingo, 1979	6,500	3	3	110	745,525	34.0
	• Pointe Indienne, 1951	5,000	3	5	140	7,308,572	36.9
	• Sandj, 1973	3,940	54	80	6,000	75,862,173	29.5
	• Tchibouala, 1980	2,110	28	30	55,100	46,787,029	27.0
	• Yanga, 1979	2,990	51	89	16,500	81,335,698	29.4
Total Congo			327	387	136,110	871,484,348	

DENMARK

DUC	• Den, 1971	6,000-6,400	41	51	27,247	87,219,243	29.5
	• Gorm, 1971	6,500-7,000	21	28	24,903	93,111,368	33.9
	• Rol, 1981	5,900	1	2	4,669	13,815,011	35.3
	• Skjold, 1977	5,000	3	7	45,347	65,804,488	30.3
	• Tyra, 1988	6,500	32	40	18,612	30,924,721	50.4
Total Denmark			86	128	126,678	270,474,831	

PRODUCTION

WORLDWIDE PRODUCTION

		— No. of wells —		Production		API gravity		
Name of field, discovery date		Depth, ft	Producing	Total	1980 average b/d		Cumulative to Dec. 31, 1980 bbl	
DUBAI								
DUPETCO ^(a)	• Fateh, 1968	7,900-9,000	141	156	406,000	2,317,992,600	31.8	
	• S.W. Fateh, 1970	7,500-9,000					30.3	
	• Fateh, 1972	8,100					25.5	
	• Rashid, 1973	9,400-11,500					38.0	
APCO	Margham, 1981	9,400-11,200	9	16	15,353	40,164,000	43.5	
Total Dubai			150	172	421,353	2,358,156,600		
ECUADOR								
TEXACO-PETROECUADOR	Atacapi, 1968	9,855	3	5	1,386	13,210,632	31.0	
	Auca, 1970	10,578	25	25	15,375	82,356,956	28.0	
	Auca Sur, 1980	9,100-10,300	2	2	567	1,840,547	25.6	
	Cononaco, 1972	11,233	9	11	12,569	35,326,700	33.3	
	Culebra, 1973	10,626	2	2	1,283	3,042,281	17.5	
	Dureno/Guanta, 1968	9,575-10,290	8	10	6,918	11,164,033	31.0	
	Lago Agrio, 1967	10,175	19	33	8,048	117,716,420	28.5	
	Parahuacu, 1966	10,173	3	5	1,055	7,157,600	30.0	
	Rumiyacu, 1982	10,191	...	1	...	184,938	21.0	
	Sacha, 1969	10,180	97	105	63,935	408,808,396	28.0	
	Shushufindi/Aguarico, 1959	9,772	51	70	100,087	850,772,391	30.0	
	Yuca, 1970	10,423	6	7	3,642	13,685,187	28.0	
	Yuca Sur, 1979	9,600-10,000	1	1	224	1,334,172	14.5	
	Yulebra, 1980	8,800-10,000	3	3	1,866	4,275,598	21.4	
	CICL ^(a)	Fanny, 1972	7,700	8	8	...	...	22.5
		Manann, 1971	7,700	5	5	...	...	20.0
		Tarapoa, 1973	8,300	1	2	...	...	20.0
	CEPE-ORIENT ^(a)	Bermajo Sur + Norte, 1967	5,000	21	26	...	...	32.5
		Charapa, 1967	10,000	1	4	...	...	29.5
Cuyabeno, 1972		8,050	15	19	69,065	262,848,047	27.4	
Liberador		...	44	50	...	...	29.7	
CEPE-PENINSULA ^(a)	Totote-Tapi, 1980	9,300	6	11	...	...	29.1	
	Ancon, 1921	4,000	439	439	...	...	35.7	
	Carpet	...	99	99	...	...	36.4	
Caulivo	...	79	79	...	...	36.4		
Total Ecuador			947	1,022	286,000	1,813,724,900		
EGYPT								
GUPCO/AMOCO	Abu Gharadig, 1972	9,500	24	33	9,838	82,282,161	35.0-55.0	
	• Badri (315), 1981	6,400	19	30	29,756	78,377,837	27.0	
	• El Morgan, 1965	5,100-6,400	99	148	78,200	1,116,222,400	27.0-32.0	
	• GH (378), 1981	8,200-9,750	1	5	128	8,199,904	24.0-28.0	
	• GS (277), 1980	8,610	1	1	1,188	3,757,952	34.0	
	• GS (345/346), 1982	7,500	1	2	314	1,340,653	35.0-38.0	
	• GS (365), 1980	10,140	...	1	...	679,175	42.0	
	• GS (381), 1985	8,700	...	1	...	1,333,873	37.0	
	• GS-327, 1983	5,800	2	1	1,630	3,215,947	20.0	
	• Hikal (404), 1982	9,200-10,000	5	9	27,324	87,436,731	32.0	
	• July, 1973	8,100-10,000	30	55	56,315	511,229,420	33.0	
	• NAG-9/9-1, 1985	10,000	2	2	1,048	2,006,875	35.0	
	• NEAG-9/15, 1984	10,635-12,128	2	3	580	1,263,332	35.0	
	• Nessum (336), 1981	6,700	1	3	228	8,967,040	29.0	
	• October, 1978	11,000	37	42	153,759	445,997,830	27.0-31.0	
	• Ramadan, 1974	11,400	23	30	29,908	406,807,025	30.5	
	• Razzak and E. Razzak, 1972	5,730-7,710	11	19	2,543	54,221,004	38.0	
	• SB (306), 1981	8,100	...	1	...	2,043,837	27.0	
	• SB (339), 1981	4,800	1	1	440	999,727	29.5	
	• SB (367), 1984	7,500	...	1	...	1,312,941	39.0	
	• SB-294, 1986	11,800	2	2	2,536	2,940,429	30.5	
	• SB-374, 1981	10,200	...	1	...	88,506	30.0	
	• SG-300, 1976	5,720-6,200	2	4	4,583	23,866,801	24.0	
	• Shoub Ali, 1978	4,700-5,500	15	49	8,939	85,982,531	28.0-33.0	
	• Sidki (382), 1977	10,500	...	1	...	42,761,720	34.0	
	• WD-33, 1972	9,700	...	1	...	2,161,591	35.0	
	• WD-33/15, 1985	5,800	2	2	1,591	2,853,726	30.0	
	• Waly (356), 1982	6,900	1	3	1,832	4,916,962	36.0	
	• Younis (347), 1981	4,300	2	6	3,533	16,865,788	32.0	
	AGIP	Belayim Land, 1983	7,000-8,500	113	122	39,638	468,594,365	21.5
		• Belayim Marine, 1981	8,500	68	78	169,745	723,622,361	29.0
		• Meleha, 1972	5,950	47	53	17,119	22,286,686	41.5
	WEPSCO/PHILLIPS PETROLEUM	El Alamein, 1968	8,700	18	19	2,574	68,476,913	34.0
		Umbarka, 1976	10,700	5	6	3,905	8,209,358	44.0
		Yidma, 1971	6,000	4	5	858	22,309,954	43.6
	BADR PETROLEUM/SHELL	Badr El Din, 1982	10,800	10	10	21,370	35,000,000	38.0
		Sira, 1982	...	...	...	548	200,000	40.0
	BUESSO (ESSO)	• East Zek, 1982	11,000	11	11	23,850	30,668,000	39.9
		REPSOL ^(a)						
	REPSOL ^(a)	Hayat, 1986	9,000	5	5	...	...	40.0
		Khaidia, 1983	7,000	6	13	...	...	35.0
		Safir, 1986	12,000	1	1	...	...	36.0
Safir North, 1986		11,800	3	3	...	...	36.0	

PRODUCTION

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
			Producing	Total	1990 average bbl	Cumulative to Dec. 31, 1990 bbl	
	Salem, 1985	8,000	18	29			35.0
	Tut, 1987	9,000	5	5			35.0
	Tut West, 1988	9,000	1	1			35.0
8UCO ^(e)	• Ras Budran, 1978	12,500	17	20			23.0-24.0
	• LL 87-2, 1975	12,000	...	1			34.0
	• Ras Farar, 1979	3,000	5	6			30.0
	• Zeit Bay, 1981	6,000	22	32			34.5
OBOCO/TOTAL ^(e)	• Shukheir Bay, 1978	6,300	1	1			34.5
	• S. Ramadan, 1982	10,000	2	2			36.5
GEYSUM ^(e)	• Geysum, 1980	5,500	5	5			17.0
EQPC ^(e)	Gharb, 1938	2,200-4,500	81	215			24.3
	Bahr/W. Bakr, 1958/1978	3,200-1,500	48	83			18.0-19.0
	Umei Yusr, 1938	3,000-3,300	19	37			21.5
	Amer, 1965	3,500	21	39			21.5
	El Ayoun, 1968	3,300	5	12	176,201	936,922,600	22.0
	Kareem, 1958	2,300	6	36			18.6
	Kheir, 1973	1,050	1	4			28.5
	Shukheir, 1968	2,500	5	11			34.0
	Ras El Behar, 1983	4,500	6	11			32.5
	Esh Elmalaha	3,700	2	2			44.0
	Sudr, 1948	2,600	12	20			21.6
	Aal, 1947	3,000	3	6			21.6
	Matama, 1948	2,000	2	2			14.6
	El Khalig, 1980	1,600	...	1			29.4
	Abu Senan T&Y, 1981	6,000	12	20			...
	Harghada, 1913	...	...	...			...
EPEDECO ^(e)	West Bakr, 1978	1,300-1,500	20	25			18.0
EGYPTCO ^(e)	Molehs, 1972	6,000	12	12			40.0
SHUKAIR MARINE CO. ^(e)	O. Suco	...	1	1			...
EL ALAMEIN ^(e)	Mors	...	1	1			...
	Total Egypt		907	1,421	872,000	5,275,804,037	

FRANCE

ALSACE	All fields	...	13	20	251	3,199,113	...
	Abandoned	...	...	...	...	24,388,362	...
AQUITAINE BASIN	Lacq Supérieur, 1949	2,170	41	71	930	26,552,807	22.3
	Parentis, 1954	7,710	51	105	5,565	201,938,186	33.4
	Lugos, 1956	5,250	18	25	438	10,457,700	20.8
	Cazaux, 1959	7,550	41	72	4,674	72,812,310	34.2/37.3
	Lavergne, 1962	11,480	4	6	310	12,508,313	41.7
	Pécorade, 1974	10,060	6	20	1,534	11,191,166	29.3
	Castéra-Lou, 1976	9,600	7	11	356	2,744,182	21.7
	Vic Bih, 1979	7,100	31	45	3,533	19,369,344	26.6
	Lagrange, 1984	6,500	2	4	5,662	10,064,587	42.5
	Other	...	7	12	185	10,453,873	...
	Abandoned	...	...	...	1	8,849,096	...
PARIS BASIN	Coulommès, 1956	6,230	24	50	358	13,803,710	32.6
	Châteaurenard, 1958	1,800	22	46	352	5,149,717	27.5
	St. Martin de Bossenay, 1959	4,590	9	13	265	8,656,405	33.0
	Villeperdue, 1959	6,100	112	156	10,697	25,316,747	34.4
	St. Firmin-des-Bois, 1960	1,800	32	62	461	10,316,720	27.5
	Chuselles, 1961	1,800	28	68	395	7,279,367	27.5
	Courtenay, 1964	1,800	24	44	465	2,926,026	27.5
	Soudron, 1976	4,600	18	29	371	2,358,398	34.4
	Donnemarie, 1979	8,040	1	6	249	2,287,591	36.2
	Cheunoy, 1983	7,350	55	79	14,372	32,835,649	37.1
	St. Germain, 1984	7,200	9	15	597	2,503,678	36.0
	Champotran, 1985	8,400	9	14	713	1,141,822	31.1
	Donnemin-Lettree, 1985	7,020	4	4	728	851,502	35.0
	Fontaine-au-Blon, 1986	6,140	10	13	1,569	1,030,301	35.4
	L'île du Gord, 1986	7,280	7	9	636	468,140	35.0
	Vert le Grand, 1986	6,230	5	6	2,941	5,492,107	34.8
	Other	...	87	133	2,596	14,683,842	...
	Abandoned	...	...	...	...	11,114,009	...
JURA & SOUTHEAST	All fields abandoned	...	...	...	...	223,063	...
	Total France		647	1,138	61,207	561,887,666	

GABON

ELF	• Anguille, 1962	9,200					31.0
	• Anguille NE, 1968	7,500					32.3
	• Anguille SE, 1962	8,200					33.0
	• Ayol Marin, 1976	7,700					19.8
	• Baliste, 1975	4,900					27.5
	• Barbier, 1972	6,000					32.6
	• Batanga, 1960	5,900					39.2
	• Baudroite Marine, 1968	7,500					29.7
	• Baudroite N., 1980	7,500					31.5

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		*API gravity
		Producing	Total	1990 average bbl	Cumulative to Dec. 31, 1990 bbl	
• Brème, 1973	5,000					37.0
• Clairette, 1956	4,400					32.5
• Dorée, 1972	7,300					30.4
• Girelle, 1973	9,400					31.0
• Gonelle, 1972	5,800					25.7
• Grand-Anguille, 1983	8,400					31.1
• Grondin Marine, 1971	7,500	216	251	104,420	1,021,185,000	28.6
• Konzi, 1962	3,600					39.0
• Mandarou, 1972	4,900					20.5
• M'Boumba, 1979	2,800					32.6
• M'Bya Sud, 1969	6,700					36.2
• Mérou Sardine, 1984	9,900					30.2
• M'Poluné, 1980	6,600					37.0
• M'Poluné W, 1982	1,700					18.0
• N'Tchengué, 1957	4,100					31.0
• N'Tchengué Océan, 1963	6,600					30.2
• Okendé, 1976	6,700					34.0
• Pageau, 1972	11,500					19.8
• Port-Genil Océan, 1964	6,000					32.2
• Port-Genil Sud Marine, 1975	7,500					32.1
• Torpille, 1968	8,200					34.0
• Torpille NE, 1982	8,200					32.3
SHELL GABON						
• Gamba/Vinga, 1963	3,000-3,100	51	84	10,137	266,300,000	31.6
• Lucina, 1971	5,900	15	22	6,575	56,200,000	38.4
• Lucina W., 1982	...	...	...	822	2,600,000	38.4
• Rabi, 1985	...	...	...	126,795	68,290,000	34.3
AMOCO						
• Oguendo B and C, 1981	5,000-6,000	17	19	8,839	41,315,045	36.0
• Oguendo Z, 1986	5,000-6,000	2	2	4,251	1,551,453	36.0
BRITISH GAS						
• Obando, 1984	8,650	2	2	2,315	2,756,929	32.0
• Octopus, 1984	10,300	3	3	937	1,507,997	33.0
• Pelican, 1985	9,300	4	4	5,579	8,040,527	37.0
Total Gabon		310	387	270,678	1,468,736,961	

GHANA

AGRI-PETCO	• Saltpond, 1977	8,500	...	3	...	3,938,000	36.0-39.0
Total Ghana			...	3	...	3,938,000	

GERMANY

BEB	• Annaveen, 1963	4,428	...	4	...	550,468	33.8
	• Berenburg, 1953	2,300-3,300	42	72	1,900	41,425,209	29.0
	• Barver, 1963	3,640	2	5	27	512,667	32.8
	• Bodenteich, 1960	4,641	1	2	13	366,374	31.1
	• Eich, 1963	5,995	7	8	1,576	2,664,180	38.9
	• Eilke-West, 1956	6,051	12	16	89	3,666,253	32.8
	• Eidingen, 1949	5,028	31	41	631	21,492,847	36.5
	• Elstleth, 1956	5,175	...	8	25	2,859,817	25.7
	• Eystrup 2, 1980	3,526	...	1	...	444,778	17.4
	• Eystrup 3-6, 1959	1,075	4	4	71	796,196	17.4
	• Eystrup-Verden, 1977	3,526	...	4	...	180,333	17.1
	• Georgsdorf, 1944	1,800-2,600	198	389	4,700	105,720,831	24.0-29.0
	• Gross Lessen, 1969	3,300	6	11	605	21,452,711	30.0
	• Hankensbüttel, Mitte, 1954	5,182	6	8	482	13,384,422	33.0
	• Hankensbüttel-Nord, 1955	5,182	4	4	341	6,553,564	33.0
	• Hankensbüttel, Ost, 1954	5,182	1	1	41	1,304,672	33.0
	• Hebelemmer, 1955	3,899	5	15	81	4,579,768	27.3
	• Hillerse-Nord, 1958	2,683	1	1	14	755,383	31.5
	• Hillerse-West, 1957	6,077	1	1	2	30,474	43.1
	• Hohenasse, 1943	1,705	...	10	7	3,560,509	30.4
	• Hohnsbösel, 1969	8,341	2	6	40	1,167,054	41.0
	• Königsgarten, 1984	6,236	3	3	204	322,104	38.1
	• Lingen-Diel (incl. Wd), 1942	3,129	38	128	134	17,059,843	31.1
	• Lüben, 1955	3,950	8	10	654	11,115,806	35.0-38.0
	• Lüben-West, 1958	4,690	5	6	...	1,586,806	36.9
	• Meerdorf, 1954	6,077	11	25	54	1,652,524	43.1
	• Meppen-Schwefingen, 1959	4,257	22	24	830	13,121,027	29.8
	• Mölme-Feldbergen, 1934	1,410	2	2	12	801,587	31.1
	• Mölme-Wachtel, 1934	3,886	3	9	3	906,440	36.9
	• Nienhagen, 1909	3,079	11	26	184	25,884,013	29.6
	• Nienhagen-Dachmiesen, 1959	3,427	4	8	72	1,072,947	27.8
	• Phulendorf-Ostrach, 1962	3,558	14	23	131	2,622,859	37.7
	• Pörlau, 1959	5,248	...	1	...	31,121	14.3
	• Rühlmoor-Malm, 1962	4,519	7	10	177	6,806,642	31.7
	• Rühlmoor-Valentia, 1949	2,381	242	443	10,801	143,678,244	24.6
	• Rühme, 1954	1,950	38	47	850	10,966,472	33.4
	• Steimbke-Ail + Nord, 1935	1,246	15	30	87	7,809,501	20.6
	• Steimbke-Lichtenmoor, 1943	2,722	14	29	100	4,057,007	17.4
	• Steimbke-Ost, 1959	4,428	3	8	49	3,780,584	30.5
	• Stockstadt, 1952	5,402	7	21	114	7,791,645	38.6
	• Suderbruch, 1949	5,175	42	61	499	23,822,843	31.1
	• Sulingen, 1973	3,345	9	9	430	5,510,212	30.0
	• Varel, 1957	5,084	5	15	144	5,845,488	25.5

PRODUCTION

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
			Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl	
MOBIL	Varth, 1984	4,129	5	6	94	384,085	31.5
	Vollensen, 1980	7,540	4	4	71	833,279	22.9
	Wehrbleck, 1957	3,342	46	61	593	17,084,174	32.0
	Wietingmoor, 1954	2,820	23	29	431	13,545,706	30.5
	Bavaria	5,640-6,190	...	20	...	7,526,952	20.0
	Hannover	980-6,630	51	68	867	31,613,436	25.0-35.0
	Hofolding, 1980	11,100	2	3	251	1,196,853	28.0-30.0
	Süd-Oldenburg, 1950	2,830-6,800	71	140	1,033	40,709,444	31.0-39.0
	Vogtel, 1953	960-1,900	74	106	691	25,385,230	32.0-34.0
	Weeser Elm	2,000-2,450	20	24	269	6,310,633	24.0
RWE-DEA A.G.	Boostedt, 1952	5,900	24	43	458	18,735,350	32.0
	Hankensbüttel-Sued, 1954	4,900	36	77	1,647	83,673,701	27.0-35.0
	Hardesse, 1957	8,200	29	68	412	9,167,066	40.0
	Hohne, 1951	5,250	28	54	681	41,456,740	33.0
	Leiferde, 1956	2,600	21	42	373	20,660,967	33.0
	Mittelplate, 1967	7,500-9,360	5	6	5,212	5,402,715	19.3
	Oerel-Sued, 1954	4,600	22	47	570	12,163,739	26.0
	Ploen-Ost, 1956	8,860	29	63	821	51,697,691	33.0
	Preetz, 1962	8,200	18	33	360	11,874,655	26.0
	Schwedeneck-See, 1978	4,900	15	18	6,016	15,319,839	29.0
WINTERSHALL A.G.	Weesendorf, 1943	4,650	14	36	369	17,783,355	25.0-40.0
	Other, 1935	2,300-8,200	14	59	381	31,432,381	19.0-37.0
	Ailingen, 1977	6,232	4	4	772	4,960,082	31.1
	Aldorf, 1952	4,100	29	103	345	17,374,010	33.0
	Ariesried, 1964	4,920-8,550	12	18	414	14,341,477	36.5
	Bockstedt, 1954	4,264	23	48	946	21,542,482	27.4
	Dickel, 1953	3,936	42	59	283	6,929,917	28.3
	Dusela, 1954	3,936	40	71	266	12,347,650	33.0
	Eicklingen, 1937	2,460	9	13	44	3,696,484	30.0
	Emichheim, 1944	3,116	89	127	3,053	46,612,952	24.5
	Hauerz, 1965	8,630	4	4	93	324,569	40.4
	Kirchdorf, 1962	5,737	1	1	13	65,562	36.5
	Landau, 1955	3,936	80	87	1,083	27,908,999	36.9
	Mazimiliansau, 1959	2,100-5,363	...	...	...	14,367	41.0
	Meckelfeld, 1954	6,396	12	27	220	14,197,039	27.5
	Moenchsrot, 1956	5,248	15	22	270	10,774,384	36.1
	Nienhagen, 1925	3,729	11	12	59	10,967,041	30.0
	Oberschwarzach, 1976	4,920	4	4	85	741,669	37.7
	Pattensen, 1954	2,165	6	7	50	1,096,324	29.3
	Rheinzbarn, 1959	3,750-5,576	1	1	25	36,225	37.9
	Ruehlertswist, 1949	2,350-2,900	64	132	1,585	32,714,041	25.0
	Ruelzheim, 1964	7,544	...	2	...	40,818	37.7
	Schwabmünchen, 1976	4,428	...	1	...	39,491	25.7
	Schwedeneck, 1956	5,182	13	29	145	8,326,026	27.5
	Wathlingen, 1936	2,624	7	10	22	1,429,874	30.0
DET	Bramberge, 1958	2,560-3,300	64	82	5,284	107,880,083	29.0
	Fronhagen, 1964	3,800	8	13	192	2,481,700	37.0
	Ilmenau, 1967	3,820	2	5	41	1,042,781	37.0
	Markdorf, 1960	7,700	...	2	...	13,912	37.0
	Memmingen-M, 1958	5,000	...	3	...	446,484	37.0
PREUSSAG	Allemöhe, 1979	6,700	1	4	72	444,086	28.0
	Assling, 1961	11,400	2	4	131	8,410,685	39.0
	Broistedt, 1937	2,600	3	17	27	1,354,600	33.0
	Darching, 1967	12,200	2	5	301	8,094,989	39.0
	Eddesse-Nord, 1950	460	31	87	126	5,817,960	26.0
	Höhenrain, 1962	12,900	1	4	23	1,979,337	39.0
	Höver, 1957	2,200	10	16	46	2,315,627	25.0
	Kronsberg, 1953	2,000	14	20	137	2,453,081	25.0
	Lehrte, 1952	4,000	10	23	56	3,231,842	31.0
	Oelheim-Süd/Rhdt, 1968	2,000	23	25	604	8,285,714	33.0
	Reilbrook-Kreide, 1937	2,300	13	159	96	15,872,441	21.0
	Reilbrook-West, 1960	6,100	16	21	410	22,629,809	30.0
	Sinstorf, 1960	7,100	12	23	480	19,662,275	30.0
	Vorhop, 1952	5,000	21	38	794	18,258,502	39.0
	Vorhop-Kneesebeck, 1956	4,100	25	35	1,501	20,439,803	35.0
C. DEILMANN AG	Adorf, 1948	5,000	28	38	693	8,107,000	28.0
	Humming, 1953	5,000-6,200	27	33	210	2,512,000	25.0-30.0
	Scheerhorn, 1949	3,550-3,750	103	154	2,000	47,198,000	30.0
EAST GERMANY ^(a)			...	...	6,000	73,000,000	...
Total Germany			2,268	4,148	78,561	1,806,416,483	

GREECE

N. AEGEAN PET. CORP.	Prinos, 1974	8,000-10,000	13	15	16,441	76,373,150	28.5
Total Greece			13	15	16,441	76,373,150	

GUATEMALA

MINISTERIO DE ENERGIA Y MINAS	Caribe, 1981	6,830	3	3	853	3,364,483	22.0-24.0
	Rubalcanto, 1974	5,300	5	7	829	6,429,773	26.0-30.0
	San Diego, 1981	17,150	...	...	...	106,753	35.0
	Tierra Blanca	11,230	1	1	1,101	786,054	19.5-23.0

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		1980 average bbl	Cumulative to Dec. 31, 1980 bbl	API gravity
		Producing	Total			
Tortugas, 1973	2,300	...	...	...	67,804	25.0
West China, 1977	3,200-3,800	3	3	393	7,337,887	31.0-35.0
Xen, 1985	8,427	2	2	682	511,483	17.0
Yalamech, 1980	15,351	1	1	85	164,982	31.0-35.0
Total Guatemala		18	17	3,843	18,787,348	

HUNGARY

OKGT/NKPV	Aigyo, 1965	5,320-6,317	723	1,210	21,583	174,197,825	41.0
	Almosd, 1977	8,143	2	2	1	367	33.8
	Asotthalom, 1967	3,198	15	20	961	10,202,320	32.1
	Battonya, 1959	3,041	17	28	74	1,404,783	39.2
	Battonya East, 1970	2,913	114	126	936	3,848,833	45.4
	Csanadapca, 1967	6,063	6	6	181	143,849	37.0
	Demjen, 1954	725-937	193	224	267	9,239,855	38.2
	Ferenczallas, 1969	7,001-7,674	29	52	463	3,054,192	41.1
	Ferenczallas East-Kiszombor, 1973	7,283	13	16	77	3,155,712	41.1
	Fuzesgyarmat, 1974	5,753-5,892	1	1	2	4,806	22.9
	Kaba South, 1978	6,548	3	4	206	706,467	34.1
	Kaszaper South, 1971	5,056	14	14	27	217,316	32.8
	Kelebia NE, 1966	3,113-3,258	4	4	38	1,063,245	37.0
	Kelebia South, 1970	2,428	6	8	257	3,236,223	17.4
	Kiskundorozsma, 1964	4,846-9,711	26	36	1,861	4,093,090	41.9
	Kisvarga, 1979	2,178-2,536	27	36	71	1,156,456	25.1
	Martfu South, 1979	6,516	8	10	73	26,782	40.0
	Mazohgyes, 1980	3,504-3,589	6	9	64	1,324,674	38.9
	Mazsas, 1978	8,432	3	3	201	79,837	40.0
	Pusztasoldvar, 1968	5,341-5,538	69	107	427	15,411,992	30.2
	Ruzsa, 1979	6,445-9,403	3	3	307	135,788	45.4
	Szeged 1971	8,629	18	25	2,220	23,841,785	41.7
	Szeghalom, 1980	6,545-6,606	42	55	1,152	1,300,200	44.5
	Szolnok, 1953	5,994	3	6	2	1,118,000	30.0
	Tokomlos SW, 1966	5,991	4	8	6	378,379	37.0
	Ulle, 1982	5,848-7,484	35	39	5	66,599	36.0
	Other	...	...	...	...	2,885,544	...
OKGT/KPV	Belezn, 1963	8,176	5	31	8	283,054	41.1
	Budafa-Kacsah, 1936	2,713-4,167	123	514	987	41,570,828	41.1
	Bugac, 1970	4,924	1	5	2	82,983	38.2
	Buzsak, 1954	1,883	...	17	4	234,389	17.4
	Kiskunhalas NE MZ, 1974	5,905	10	34	204	1,794,381	31.2
	Kiskunhalas NE PZ, 1974	6,119-6,594	22	74	864	9,086,012	27.5
	Lovasz, 1940	3,510-4,301	75	479	443	40,828,477	41.3
	Mazsokonya West, 1967	5,938	...	...	21	9,885	27.5
	Nagyenyel, 1951	5,545-6,235	71	480	5,004	128,534,083	16.0
	Ortahaza, 1970	4,580-6,089	10	36	117	4,127,418	35.2
	Ortahaza East, 1986	5,413	4	12	57	82,901	31.1
	Pusztasapall, 1973	8,300	2	11	32	1,036,489	22.3
	Szank, 1964	5,827-5,932	22	110	507	16,482,527	38.7
	Szank NW, 1977	5,495	...	...	48	913,598	41.1
	Szank West, 1968	6,106-6,201	1	10	8	19,234	28.7
	Tazlar, 1966	6,365-6,880	2	23	21	383,304	24.0
	Tazlar Nord, 1968	7,129-7,415	1	7	90	43,741	32.5
	Zalekaros-Savoly, 1979	5,463-5,791	6	34	1,112	2,885,329	20.7
	Other	...	...	...	...	7,336,704	...
	Total Hungary		1,738	3,907	40,813	527,867,988	

INDIA

WESTERN	Ankleshwar, 1980	1,969-6,584	124	283	14,878	43,475,676	40-43.0
	Beloi, 1970	1,000-1,100	91	171	3,791	3,923,520	16.0
	Gandhar, 1984	9,846-12,145	39	108	21,154	18,814,780	48.0
	Jhabara, 1976	1,200-1,300	74	108	9,325	30,143,780	24-29.0
	Jotana, 1977	1,100-1,500	44	79	13,154	16,819,600	40.0
	Kadi, N., 1967	3,810-7,220	162	238	11,831	58,840,640	21.0
	Kadi, S., 1968	8,892-9,846	...	39	...	3,812,000	24.0
	Kaloi, 1961	4,585-10,830	203	368	10,828	49,849,200	36-39.0
	Lanwa, 1972	950-1,140	71	106	3,125	2,108,180	15.0
	Motwan and Siadora, 1974	1,500-1,700	26	62	3,489	17,253,240	48.0
	Nadia, 1968	2,800-3,500	3	9	1,285	1,515,240	40.0
	Nevagam, 1983	4,595-10,174	84	133	2,864	27,274,320	35-37.0
	Sanand, 1962	4,267-10,100	...	88	...	10,317,000	28.0
	Santhal, 1971	1,000-1,100	77	147	9,520	31,780,780	17.0
	Sobhasan, 1968	4,595-9,848	77	135	12,362	8,322,840	29.0
	Vinaj, 1978	4,595-9,823	25	39	2,686	5,731,580	20.0-24.0
EASTERN	Chang Pang, 1973	8,861-10,502	13	20	2,430	5,746,200	...
	Geleki, 1968	9,518-14,789	77	173	8,758	82,617,820	30.0
	Laksh-Lakhmani, 1984	6,584-14,113	222	377	28,877	162,079,440	33.0
	Rudrasagar, 1980	7,877-13,128	47	119	6,178	36,323,040	28.0
	Others	...	21	162	5,175	9,106,080	...
BOMBAY OFFSHORE	• B-38 (Heera), 1977	4,267-8,584	45	65	27,999	56,708,040	37.0
	• Bombay High, 1974	3,282-7,877	313	507	402,797	1,234,971,800	30.0
	• Panna (North Basin), 1978	4,823-7,549	7	14	2,825	1,885,880	38.0
	• Ratna, 1979	7,500	3	10	1,299	9,186,800	38.0
	• Others	...	4	5	622	322,080	...

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
		Producing	Total	1990 average b/d	Cumulative to Dec. 31, 1990 bbl	
SOUTHERN						
Adiyakum Mangalem, 1969	2,200	2	4	197	153,720	40-43
Lingale, 1969	2,100	1	3	205	109,800	40-43
Nerimanam, 1965	6,236-7,549	15	24	5,753	3,762,800	43-45
Others		1	10	183	175,680	48-52
OTHER FIELDS						
Bakrol, 1966	2,626-9,848	...	3	...	37,000	...
Digboi, 1960	300-7,500	228-468	563	86,361,895	...	...
Dikom, 1991	3,612	...	...	...	...	...
Jorajan, 1967	7,000-11,500	130	204	21,659	80,465,535	25.0-34.0
Kathaloni, 1991	3,552	...	...	...	...	...
Kathana, 1965	5,250-5,906	...	33	...	5,103,000	25.0
Kharseng/Ningru, 1976	3,300-5,000	26	39	827	...	...
Kholka, 1966	5,579-7,877	...	19	...	636,000	...
Kosamba, 1963	1,313-8,533	...	23	...	978,000	...
Moran, 1958	11,000	63	91	8,425	112,362,725	...
Nakhorkatsya, 1953	9,500	196	335	23,065	376,392,725	...
Wavel, 1962	4,595-7,220	...	...	...	168,000	...
Total India		2,514	4,828	664,586	2,530,353,236	

INDONESIA

PERTAMINA UEP I						
Besitang, 1977	3,973	3	16	21	2,201,000	51.5
Gebeng, 1977	2,917	17	50	447	5,789,900	54.0
Kuala Simpang Barat, 1971	3,740-5,019	20	36	3,401	22,112,700	45.0
Kuala Simpang Timur, 1967	...	4	23	22	1,375,300	...
P. Tabuhan Barat, 1937	3,350-5,893	19	32	524	7,052,900	50.8
P. Tabuhan Timur, 1968	...	31	113	647	20,355,000	...
Rantau, 1929	2,764	84	492	3,873	241,067,800	45.3
Sarang Jaya, 1926	3,701	20	79	313	3,868,900	47.6
Sungai Buluh, 1984	3,701	5	8	266	1,396,300	...
Kuala Dalam, 1983	...	16	19	596	1,728,900	...
Pulau Panjang, 1928	...	...	64	2	14,653,000	...
Securai, 1980	...	7	14	334	11,191,800	...
PERTAMINA UEP II						
Abab, 1951	6,000	17	95	388	38,872,800	36.0
Benakat, 1932	1,600	61	206	1,511	134,833,000	35.0
Jirak, 1930	2,300	35	155	339	51,983,000	35.0
Talang Akar, 1922	2,800	26	344	749	347,232,800	35.0
Deras, 1937	...	2	4	79	1,649,100	...
Dewa, 1936	...	9	32	65	8,719,500	...
Betun, 1935	...	2	8	147	6,098,300	...
Candi, 1937	...	2	2	31	169,900	...
Kruh N., 1935	...	1	6	9	315,700	...
Raja, 1950	6,000	20	101	1,352	32,418,300	38.0
Sukaraja, 1934	...	...	...	43	1,474,800	...
Bajubang, 1930	...	17	111	321	41,076,500	...
Betung Jambi, 1951	...	9	201	95	2,582,600	...
Kenali Asam, 1931	2,077	60	163	1,185	94,360,200	29.0
Ketaling Timur, 1982	...	8	10	227	163,200	...
Setiti, 1960	...	7	20	169	2,766,200	...
Sungai Gelam, 1956	...	1	7	55	215,700	...
Sungai Lili, 1954	...	23	27	685	3,853,900	...
Tampino, 1931	1,647	47	161	941	86,972,300	23.0
Belimbing, 1965	5,371	7	29	756	21,386,200	...
Benakat East, 1973	...	27	52	1,083	17,628,400	...
Benuang, 1942	6,103	33	46	377	7,901,800	35.1
Gn. Kemala, 1938	5,448	20	76	1,405	28,260,900	38.0
Kuang, 1940	5,249	6	16	369	7,389,500	25.1
Limsu, 1928	3,896-4,626	58	261	1,803	189,227,100	...
Ogan Timur, 1943	3,793	11	28	377	4,211,200	27.4
T. Miring, 1935	640	25	47	1,101	12,183,500	...
Talang Jimar, 1937	4,123	35	304	1,201	172,160,700	31.0
Tanjung Tiga, 1938	3,750	37	107	977	58,261,700	28.0
Karangan, 1975	...	...	...	84	1,027,200	23.0
Beringin, 1975	...	...	...	921	426,900	...
Betung, 1966	...	...	...	245	750,000	...
Limsu Niru, 1954	...	...	...	747	25,262,300	...
Musi, 1965	...	...	...	1,007	1,813,500	...
Prabumulih Barat, 1953	...	...	...	164	11,180,700	...
Air Serdang, 1986	...	...	...	190	195,100	...
Andan, 1950	...	3	8	107	8,802,900	...
Bilmbing, 1952	...	2	3	15	716,100	...
Uluk/Pondok, 1950	...	5	9	104	5,246,500	...
Lirik, 1939	1,800	33	46	1,109	38,955,900	34.0
Molek, 1956	2,600	13	27	209	11,877,100	34.0
N. Pulau, 1941	1,800	15	39	343	37,450,000	34.0
S. Pulau, 1941	1,800	12	17	208	5,101,700	34.0
Sego, 1940	1,800	61	84	2,905	124,512,400	34.0
PERTAMINA UEP III						
Cemara, 1976	3,964-7,104	19	34	825	6,101,200	...
Jeliberang, 1969	3,053	88	141	3,318	86,931,400	29.0
Tugu Barat, 1979	3,014	13	22	1,532	5,500,000	...
Kandang Haur Timur, 1979	...	4	8	41	1,266,200	...
MB STR, 1985	...	15	15	5,180	7,480,400	...
Pegaden, 1986	...	1	2	86	90,900	...
Randegen, 1973	...	4	11	53	546,000	...

PRODUCTION

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
			Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl	
PERTAMINA UEP IV	Karwogen, 1926	...	...	...	2,086	87,044,900	...
	Ledok, 1893	...	...	...	118	25,207,900	...
	Nglobo, 1896	...	...	...	236	5,359,600	...
	Semanggi, 1896	...	...	...	34	5,446,300	...
	Bunyu Nibung, 1923	2,077	40	106	2,663	63,321,300	33.2
	Sembakung, 1976	2,600	16	17	3,108	229,600	36.0
	Tapa-Tentip, 1975	...	10	20	244	471,700	...
	Bengkadulia, 1960	3,250	1	1	12	548,500	39.5
	Sakimah	...	1	2	38	320,300	...
	Sangatta, 1939	1,842	39	95	2,492	22,770,100	33.0
PERTAMINA UEP V	Tanjung, 1938	2,296	57	85	1,482	103,545,800	39.9
	Tapian Timur, 1967	4,396	11	20	577	5,860,600	36.8
	Warukin, 1956	2,067	22	31	741	10,862,800	26.9
	Dahor Selatan, 1966	...	2	2	50	50,900	...
	Tanta, 1975	...	1	1	8	6,900	...
	Kambelin, 1981	3,491	2	8	90	246,000	...
	Klamono, 1936	574	53	67	967	35,616,500	19.0
	Linda, 1977	3,281	10	18	426	1,154,100	19.0
	Salawati, 1977	...	7	18	679	29,142,900	...
	Sela, 1951	2,156	7	16	172	1,547,500	35.0
TOTAL CFP	Bekapai, 1972	4,600-15,600	42	45	9,671	163,700,000	40.0
	Handil, 1974	2,900-19,200	230	280	62,479	700,104,900	33.0
	Tambora, 1960	8,000-13,000	16	36	574	12,190,600	33.0
	Tunur ⁽¹⁾ , 1965	8,001-13,000	5	26	1,474	538,000	55.0
ARCO	Ardjuna, 1969	2,380-7,250	333	387	91,145	750,505,000	37.0
	Anmbi, 1972	2,943	29	33	8,370	33,086,000	33.0
	Bima, 1983	3,000-3,888	55	59	9,200	19,254,000	34.0
	NWC, 1974	5,411-5,800	29	36	9,378	10,465,000	31.5
KODECO ENERGY	Madura, 1975	...	5	14	980	3,818,600	...
AMOSEAS	Anoa, 1984	...	9	9	2,299	639,000	...
AGL PETROLEUM (SERAM) LTD.	Bula, 1897	2,000-1,300	75	355	1,258	15,978,000	23.0
CHEVRON & TEXACO	Batang, 1975	690	11	13	795	2,607,000	19.0
	Benue, 1978	2,400	21	25	10,025	24,686,300	37.0
	Beruk, 1974	1,750	21	28	12,934	55,632,200	36.0
	Beruk NE, 1976	1,800	3	6	55	1,766,500	40.0
	Beruk North, 1965	1,900	8	7	1,548	1,381,700	38.0
	Buaya, 1976	2,035	...	2	...	191,000	28.0
	Bungau, 1976	2,050	7	8	701	11,625,200	36.0
	Bulun, 1982	4,000	9	9	19,351	9,173,000	44.0
	Damar, 1974	4,650	5	6	471	4,950,900	34.0
	Dusun, 1979	2,550	6	7	732	5,979,300	42.0
	Gatam, 1977	2,385	...	3	...	627,200	34.0
	Idris, 1983	2,450	1	3	400	916,100	39.0
	Jingga, 1984	6,500	3	3	1,702	1,204,400	45.0
	Kasikan, 1972	660	22	29	1,189	6,954,600	28.0
	Langgek, 1976	1,380	26	28	2,263	6,396,600	32.0
	Lindai, 1971	1,100	18	20	1,165	7,566,300	32.0
	Mengala S., 1968	3,765	2	2	673	16,187,700	34.0
	Mengkapen, 1981	4,000	1	1	301	1,139,900	44.0
	Osam, 1978	900	6	7	203	1,062,900	32.0
	Paitan, 1976	2,315	1	1	164	864,100	32.0
	Pedada, 1973	950	30	31	11,345	77,118,200	33.0
	Pusaka, 1977	2,250	20	25	7,575	17,431,200	36.0
	Rintis, 1984	6,450	1	1	265	237,800	39.7
	Sabak, 1974	2,350	16	17	1,408	19,612,000	36.0
	Tanjung Medan, 1976	2,770	2	7	678	2,578,600	34.0
	Terentang, 1973	900	4	6	304	866,500	32.0
	Zamrud, 1975	3,600	52	55	19,299	78,986,600	40.0
	Ujung Tanjung, 1975	3,600	1	3	270	98,500	34.0
	Pas, 1988	3,667	2	2	315	114,900	35.0
CALTEX PACIFIC INDONESIA	Ampuh, 1981	6,000	10	14	2,142	3,042,000	36.0
	Antara, 1978	1,425	5	6	916	4,242,500	36.0
	Balam S., 1969	1,800	59	62	9,178	105,156,600	33.0
	Balam SE, 1972	4,500	13	13	618	7,112,500	29.0
	Bengkong, 1970	1,950	86	97	27,223	398,499,300	34.0
	Batang CPI, 1975	690	7	7	608	1,363,000	19.0
	Bekasap, 1955	2,950	52	68	16,563	419,607,600	34.0
	Bekasap South, 1968	3,900	6	14	844	27,822,900	34.0
	Benar, 1973	2,450	28	34	4,178	60,600,100	33.0
	Cebakan, 1974	4,700	4	5	520	4,843,900	30.0
	Aman, 1974	4,700	10	10	1,272	27,546,100	36.0
	Cucuk, 1981	5,800	2	3	403	279,200	33.0
	Duri, 1941	770	1,558	2,042	165,200	581,682,000	22.0
	Ganuk, 1980	4,600	...	2	...	119,200	31.0
	Hitam, 1975	6,690	4	5	1,011	2,755,800	36.0
	Hui, 1983	5,900	3	4	1,074	1,124,600	40.0
	Intan, 1977	3,350	6	7	1,427	7,843,000	33.0
	Jorang, 1972	5,500	17	21	9,345	43,636,300	36.0
	Karang, 1977	3,900	11	14	1,822	6,840,400	39.0

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
		Producing	Total	1990 average b/d	Cumulative to Dec. 31, 1990 bbl	
Koper, 1974	5,300	12	24	4,381	15,400,000	37.0
Kotabatak, 1952	5,500	86	141	20,096	150,559,000	29.0
Kulin, 1970	2,050	63	71	5,501	35,355,800	20.9
Libo, 1988	6,000	2	12	830	7,025,000	35.0
Libo SE, 1973	5,900	22	29	8,096	7,909,300	42.0
Lincak, 1981	2,570	4	4	288	2,984,300	35.0
Menggala N., 1968	3,850	18	22	3,928	87,028,900	33.0
Menggala S. CPI, 1968	3,785	6	9	1,299	32,806,300	34.0
Minas, 1944	2,800	460	627	284,701	3,521,093,800	35.0
Mindel, 1971	3,400	2	5	41	3,119,800	37.0
Mutera, 1976	3,500	2	2	9	1,901,300	34.0
Nella, 1977	5,000	3	5	33	870,100	35.0
Obor, 1978	7,370	2	4	543	2,534,500	40.0
Pager, 1974	4,300	25	28	6,506	80,812,800	38.0
Palita, 1977	6,600	4	7	820	4,771,200	39.0
Pematang, 1959	3,750	34	46	7,432	224,473,500	32.0
Pematang Bow, 1969	5,300	11	19	1,934	8,600,800	33.0
Pemburu, 1981	2,300	10	11	2,778	11,177,300	35.0
Perkebunan, 1977	2,300	1	1	168	379,400	29.0
Petani, 1964	4,750	35	38	11,493	282,054,200	33.0
Petapahan, 1971	4,500	21	32	4,529	96,200,100	28.0
Pinang, 1971	3,950	18	22	3,796	28,661,600	30.0
Pinggir, 1972	3,300	3	7	170	4,604,800	35.0
Pinggir S., 1973	3,300	2	4	62	2,071,600	39.0
Pudu, 1972	5,950	7	13	1,406	29,040,100	35.0
Puncak, 1979	2,400	15	18	2,956	16,288,300	36.0
Pungut, 1951	3,400	26	34	4,193	49,582,600	36.0
Rangau, 1966	6,100	3	13	345	8,536,000	42.0
Rantaubaru, 1972	1,070	14	18	524	1,037,400	18.0
Rukin, 1979	6,100	1	4	523	1,022,800	41.0
Mangea, 1988	7,800	1	1	345	126,000	34.0
Seruni, 1972	3,000	23	25	7,059	50,193,700	35.0
Sikedi, 1975	4,340	19	21	2,219	21,100,200	40.0
Singa, 1977	3,200	1	2	...	437,000	31.0
Sintong, 1971	3,400	24	25	2,733	56,929,500	32.0
Sintong SE, 1973	4,500	1	1	85	1,290,100	36.0
Suram, 1971	1,750	3	7	284	3,824,500	28.0
Tandun, 1969	3,000	12	13	2,184	14,416,000	33.0
Telinga, 1975	4,205	7	10	625	3,786,600	33.0
Topaz, 1977	5,200	7	8	1,807	17,743,500	33.0
Topi, 1979	3,630	1	1	88	598,600	37.0
Tunas, 1983	4,819	2	2	279	399,100	35.0
Ubi, 1976	4,350	24	25	2,557	14,931,300	35.0
Waduk, 1982	6,100	9	13	135	4,860,300	38.0
Tanggul, 1977	3,700	2	2	436	159,400	30.0
ASAMERA (NORTH SUMATRA)						
Alur Cimon, 1972	3,088	...	34	...	4,379,000	50.8
Geudondong, 1965	3,192	...	32	...	5,200,000	23.1
lee Tabau, 1971	2,721	2	73	16	11,904,400	50.3
Julu Rayau, 1968	2,832	7	65	282	12,425,500	53.6
Peudewe, 1980	3,083	...	30	...	1,567,400	48.1
Tualang, 1973	2,631	11	75	1,033	30,900,700	49.9
ASAMERA (SOUTH SUMATRA)						
Benitayan, 1932	4,446	15	24	2,285	2,391,200	22.0
Keri, 1965	3,957	2	3	80	106,200	41.5
Kluang, 1913	2,591	25	54	505	34,224,500	42.6
Mangunjaya, 1934	2,700	5	109	173	23,145,900	32.0
Panerokan, 1976	4,915	2	8	23	206,800	39.4
Ramba, 1982	3,150	62	78	13,001	55,329,000	37.0
Rawa, 1985	4,038	22	41	6,885	6,506,300	38.7
South Rawa, 1985	4,086	2	3	165	178,200	37.0
Supet, 1964	4,626	10	12	1,955	998,000	33.6
Tanjung Laban, 1982	3,580	21	30	885	6,887,300	38.1
Tempino, 1931	4,493	3	192	148	1,457,400	40.9
MAXUS ENERGY						
• Gita, 1970	3,500	45	60	10,118	186,121,000	34.0
• Duma, 1983	2,300	2	6	49	785,000	24.0
• Fanda, 1982	8,000	11	22	3,019	13,957,000	32.0
• Gita, 1972	5,000	5	9	529	7,925,000	34.5
• Intan, 1989	5,000	15	16	32,868	18,534,000	32.6
• Karmila, 1983	4,800	4	8	4,532	33,972,000	36.0
• Kitty, 1973	2,700	6	8	1,159	14,805,000	38.0
• Kriana, 1979	4,500	23	43	6,614	84,631,000	37.0
• Nora, 1973	3,200	3	5	482	9,138,000	29.0
• Rana, 1974	3,200	32	73	6,296	85,856,000	31.0
• Selandi, 1971	4,000	7	19	808	21,468,000	19.0
• Sunderi, 1982	4,400	9	15	1,767	12,471,000	25.0
• Tio, 1982	8,000	...	5	...	1,656,000	33.0
• Wanda, 1984	4,800	1	5	36	1,651,000	36.0
• Yvonne, 1980	4,500	8	11	2,792	14,744,000	36.0
• Zaida, 1971	7,500	23	47	6,277	41,457,000	33.0
• Intan NE, 1989	5,000	6	6	104	38,000	32.6
• Widuri, 1989	5,000	30	35	10,951	3,997,000	24.0
PETROMER TRENO						
Candrawasih, 1976	3,500	16	27	1,232	13,310,800	26.7
Jaya, 1973	3,050	13	21	1,008	36,547,200	38.7

PRODUCTION

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
			Producing	Total	1990 average b/d	Cumulative to Dec. 31, 1990 bbl	
STANVAC (CENTRAL SUMATRA)	Kasim, 1972	3,350	40	57	2,782	49,518,200	36.5
	Kasim Barat, 1975	4,412	1	7	139	3,040,700	33.3
	Kasim Utara, 1975	5,058	3	11	182	8,335,300	26.4
	Kaserai, 1981	2,900	...	...	...	25,300	32.5
	Moi, 1979	4,731	4	8	166	799,700	19.4
	Wato, 1975	2,750	247	297	12,890	181,564,800	34.3
	Bino, 1972	1,600	13	37	342	12,101,000	34.0
	E. Kayura, 1983	3,500	45	84	3,167	9,670,000	35.0
	Gemuruh, 1983	2,800	16	22	1,121	3,150,000	34.0
	K. Ara, 1980	3,944	7	18	268	2,249,000	35.4
	Kerumutan, 1980	3,000	11	42	811	5,623,000	35.0
	Merbau, 1979	2,700	30	47	998	7,496,000	36.0
	Mutara, 1985	2,700	2	2	44	148,000	34.0
	N. Merbau, 1980	2,800	6	17	345	3,083,000	36.0
	Panduk, 1981	2,500	6	12	219	1,689,000	46.0
STANVAC (SOUTH SUMATRA)	Parum, 1987	4,200	16	23	2,449	2,278,000	35.0
	Pakan, 1976	3,700	13	48	414	8,135,000	35.0
	Gunung Kembang, 1979	4,000	3	6	274	117,000	36.0
	Rul, 1970	5,700	16	54	619	22,420,000	36.0
	Jene, 1985	6,500	24	47	17,178	27,178,080	35.0
	* Kerang (PSC), 1984	2,900	4	7	466	1,344,000	35.0
	Lagen, 1986	2,400	5	8	236	390,000	36.8
	Pian, 1986	6,000	4	10	499	279,000	36.0
	Rambutan, 1972	4,500	8	24	99	3,225,000	42.0
	Rimbait (PSC), 1984	3,200	3	4	110	204,000	34.0
	S. Tabuan, 1980	3,000	1	5	27	45,000	...
	* Tabuan (PSC)	4,000	6	11	548	1,977,000	34.0
	Taras, 1951	3,000	3	4	121	833,000	37.0
VIRGINIA INDONESIA	Bedak, 1972	5,190-10,600	135	168	13,151	83,400,000	34.4
	Mutara, 1984	900-5,800	8	38	3,014	6,100,000	38.5
	Niam, 1974	7,500-11,500	90	115	15,890	42,200,000	33.4
	Pameguan, 1974	900-5,100	14	32	1,844	8,000,000	26.8
	Semberah, 1974	2,900-10,100	...	38	...	565,000	30.0
	Walewi, 1974	5,000-6,000	6	6	6	46,200	32.0
UNOCAL	* Ataka, 1970	7,500	90	121	50,878	503,815,000	39.0
	* Kerindingan, 1972	7,000	...	14	...	5,034,000	23.8
	* Melahin, 1972	7,500	4	9	732	7,054,000	23.1
	* Rajah, 1981	5,500	...	...	...	...	33.8
	* Sepinggan, 1973	11,150	34	39	18,592	58,232,000	34.0
	* Yakin, 1976	5,100	20	38	5,495	25,617,000	18.8
CONOCO GROUP	* Ikan Pari, 1983	4,500	4	4	6,200	3,052,700	47.0
	* Kepiting, 1982	6,000	...	2	...	2,563,200	37.0
	* Udang, 1974	5,595	17	28	3,488	61,367,000	40.0
	* Wniegar, 1984	3,500	3	3	2,575	939,700	38.7
MOBIL OIL	Arun ⁽¹⁾ , 1971	10,050	54	89	121,382	425,500,000	55.0
MARATHON	* Kekap KH, 1980	8,500	8	8	5,280	17,489,000	45.0
	* Keap KF, 1984	8,100	14	14	27,041	9,923,700	49.0
HUBBARD (MALACCA STRAIT)	* Kurau, 1986	4,500-9,000	20	22	26,259	22,484,700	47.4
	* Lalang, 1980	3,100-3,800	11	18	5,531	36,418,800	39.6
	* Melbur, 1984	900-1,300	17	25	8,042	12,035,500	35.6
	* Mengkapen, 1981	3,850-4,450	9	10	6,044	22,708,200	42.0
	* Selatan, 1987	3,900-4,500	8	14	207	455,700	...
TESORO INDONESIA PETROLEUM	* Semboja, 1909	380-4,380	26	99	2,263	286,378,000	25.0
	* Sanga Sanga, 1997	275-6,000	108	244	1,959	182,593,000	31.0
	* Tarakan, 1906	200-6,540	122	1,167	922	74,678,000	19.0
TARAKAN PETROLEUM	Tarakan (Mamburungan field), 1984	5,020-5,131	2	4	537	285,000	31.1
Total Indonesia			7,262	14,898	1,498,725	14,143,534,380	
IRAN	* Abcozar, 1969	2,800	...	...	...	...	27.0
	* Agha Jari, 1936	7,440	58	89	...	...	34.0
	* Ahwaz Asman, 1958	8,150	73	85	...	...	32.0
	* Ahwaz Bangeestan, 1958	12,000	...	7	...	...	24.3
	* Behngensar, 1980	9,000	...	...	...	...	30.0
	* Bibi Hakimeh, 1981	4,570	19	33	...	...	29.9
	* Bineh, 1959	10,440	...	4	...	...	29.9
	* Chasemeh Khush, 1967	10,700	...	4	...	...	27.7
	* Chilingar, 1974	3,350	...	1	...	...	38.3
	* Cyrus, 1962	7,000	...	...	...	...	18.3
	* Darius, 1961	11,000	...	...	...	...	34.0
	* Dehluran, 1972	11,900	...	6	...	...	31.0
	* Forozan, 1968	7,000	...	...	...	...	28.5
	* Gachasan, 1937	3,400	46	62	...	...	31.0
	* Heft Kal, 1927	1,980	2	11	...	...	37.7
IRAN	* Hendjan, 1968	11,000	...	...	...	...	23.0
	* Karanj, 1983	5,380	7	7	...	...	33.9
	* Kharq, 1961	10,800	...	...	...	...	31.6
	* Kupai, 1965	10,500	...	7	...	...	32.8
	* Lab-e Sefid, 1988	4,350	...	7	3,282,000	38,179,417,084	35.3

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
		Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl	
Manar, 1963	7,100	4	8			28.4
Manar, 1963	9,400	55	112			32.6
Masjed-e Suleiman, 1908	1,800	7	24			39.3
Naft Safid, 1938	5,000	5	19			36.8
Naft-Shahre, 1923	2,000-3,000	...	...			43.0
• Nowruz, 1966	8,200	...	...			21.0
Par-e Siah, 1964	4,250	...	1			37.7
Pars, 1964	4,670	22	27			38.8
Pazanan, 1961	7,250	44	71			37.2
Rag-e Safid, 1964	7,230	19	29			28.6
Ramin, 1966	12,200	...	...			32.9
Ramshe, 1962	8,750	...	3			27.6
• Resalat, 1969	7,650	...	...			35.8
• Reshadat, 1966	7,000	...	...			34.4
• Salman, 1965	7,500-8,100	...	...			34.0
Shadegan, 1969	...	...	...			...
Soroush, 1962	7,000	...	...			18.3
Tabatabaei, 1971	3,400	...	...			30.4
Total Iran		381	618	3,352,000	38,178,417,084	

IRAQ^(a)

INOC	Abu Ghurab, 1971	9,600	12	16			24.0
	Ain Zalah, 1939	5,200-6,500	15	28			31.0
	Bai Hassan, 1953	4,800-5,400	56	84			34.0
	Salad, 1983	6,000-7,000	4	8			25.0
	Butmah, 1953	3,900	1	17			31.0
	Buzurgan, 1970	12,000	20	22			24.0
	East Baghdad, 1975	6,000-7,000	32	79			23.0
	Hamm, 1973	2,000	...	14			30.0
	Jebel Fauqi, 1974	10,000	20	23			25.5
	Jambur, 1954	5,500-12,500	27	50	2,080,000	22,430,413,000	38.0
	Kirkuk, 1927	2,800-4,200	71	289			36.0
	Luhari, 1961	8,200	12	21			33.0
	Naft Khaneh, 1909	3,500	7	11			42.5
	Nahr Umar, 1949	8,200	5	13			42.0
	Osliyah, 1929	650	33	50			16.0
	Rumaila North, 1958	10,300	303	443			33.0
	Rumaila South, 1953	10,200	133	208			34.0
	Sulayyah, 1978	3,900	11	39			25.0
	Wasi Takt, 1985	8,200	2	6			23.0
	Zubair, 1949	10,200	56	110			35.0
Total Iraq			820	1,511	2,080,000	22,430,413,000	

^(a)Prior to conflict in the Persian Gulf.

ISRAEL^(a)

LAPIDOTH	Heletz-Brur, 1955	5,200	4	18			29.2
	Kochav, 1962	5,500	6	13			27.9
OEIL	Ashdod, 1976	8,400	2	2	248	17,010,100	32.5
EMOG	Gurim, 1984	3,280	...	...			17.0
Total Israel			12	33	248	17,010,100	

ITALY

ELF	• Rospo Mare, 1975	4,600	19	20	27,873	34,658,319	12.2
	• Santa Maria e Mare, 1974	7,900	8	9	720	18,256,871	22.3
	• Serago Mare, 1979	5,200	4	6	3,771	12,715,186	8.1
AGIP	Benevento, 1974	10,355	1	1	688	644,000	38.0
	Cammarata/Pozzillo, 1969	10,498	4	4	108	1,646,000	8.3
	Cavone, 1973	9,350	10	14	2,700	9,873,000	21.5
	Cortemaggiore, 1949	6,582	3	5	111	7,707,000	33.2
	Costamolina, 1963	12,785	1	1	82	34,000	17.8
	• Emilio, 1971	8,530	1	1	411	849,000	10.7
	Gagliano, 1982	14,784	2	2	328	583,000	37.2
	Gela, 1956	10,827	63	86	8,162	121,818,000	10.0
	Gleuone, 1982	10,170	2	5	188	83,000	10.2
	Maloesa, 1973	17,080	2	4	340	28,382,000	52.9
	Monte Alpi, 1988	11,483	1	2	23	108,000	37.2
	• Parla, 1978	7,874	3	4	53	1,956,000	13.3
	Pisticci-S. Cataldo, 1980	6,980	8	11	1,208	8,783,000	12.0
	Porte-Dinilo, 1959	9,514	9	11	1,865	12,483,000	15.6
	• Prazioso, 1982	15,748	8	8	4,823	3,024,000	19.7
	Regusa, 1953	4,583	37	38	4,044	131,032,000	19.3
	S. Maria Imbaro, 1983	7,545	3	3	319	480,000	15.9
	Torreme Tona, 1983	4,101	8	13	933	2,988,000	31.9
	V. Fortuna, 1984	18,044	5	12	11,818	9,614,000	48.3
SALM	Vega, 1980	8,500	20	24	13,200	24,830,178	18.0
Total Italy			223	284	83,488	436,067,884	

IVORY COAST^(a)

SNOP	• Beller, 1975	6,500-7,000	13	18			34.6
PETROCI	• Espoir, 1980	6,500-11,000	...	...	2,000	50,224,071	32.3
Total Ivory Coast			13	18	2,000	50,224,071	

PRODUCTION

WORLDWIDE PRODUCTION

			No. of wells		1980		Cumulative to					
	Name of field, discovery date	Depth, ft	Producing	Total	average b/d	Dec. 31, 1980 bbl		API gravity				
JAPAN	JAPEX • Aga-Oki, 1972	7,380	6	6	638	3,526,388	24.8					
	Higashi-Nigata, 1965	4,800-9,200	20	32	984	8,089,844	53.9					
	• Inatune-Oki, 1984	5,050-8,800	1	1	588	10,244	—					
	Katakai, 1960	3,310-16,300	3	18	468	942,895	90.0					
	Sarukawa, 1958	2,000-3,200	84	133	1,263	18,006,416	32.3					
	Yoshi, 1958	8,000	10	24	582	9,327,742	61.8					
	Yurihara, 1978	1,310-7,810	11	14	216	573,388	43.5					
	Other	—	43	88	323	22,479,613	—					
	IOEIMTSU OIL • Aganiki-Kita, 1982	4,950	10	10	1,840	7,100,000	37.0					
	TEIKOKU Hagashi-Kashiwazaki, 1970	8,000-8,900	6	10	558	8,496,196	62.0					
	Kubiki, 1959	1,100-6,400	73	129	684	12,074,587	29.7					
	Minami-Aga, 1964	7,300-9,600	7	35	500	14,196,627	36.5					
	Minami-Nagasaki, 1984	13,200-15,100	5	14	582	1,310,557	55.7					
	Yabasa, 1933	1,100-5,800	52	80	373	33,496,872	33.0					
	Other	—	12	13	77	2,766,405	—					
Total Japan			343	607	9,347	142,406,953						
JORDAN	NRA Hamzah, 1984	9,500	4	17	327	617,000	30.0					
	Total Jordan			4	17	327	617,000					
KUWAIT ^(a)	KOC Burgan, 1938	4,800	210	393	1,079,000	24,113,888,000	30.8					
	Ahmedi, 1952	4,800	11	84			31.7					
	Magwa, 1951	4,800	71	113			33.0					
	Raudhatain, 1955	8,800	41	53			34.4					
	Bahra, 1956	8,500	—	2			—					
	Sabriya, 1957	8,300	9	44	1,079,000	24,113,888,000	36.3					
	Minagish, 1959	10,000	1	21			34.4					
	Umm Gudair, 1962	9,000	20	33			26.9					
	Total Kuwait			283	743	1,079,000	24,113,888,000					
	LIBYA	AGIP Bour, 1979	8,300	40	41	73,943	42,785,866	25.8				
Su Attili, 1968		14,000	34	37	170,051	946,867,160	40.7					
Rimat, 1965		11,000-14,000	4	6	4,806	9,519,537	33.2					
Katib, 1969		12,300	1	1	255	504,430	36.3					
ELF ^(a) El Mehairiga		10,500	1	2	1,125,145	16,464,319,040	46.0					
LNOC ^(a) Arshad, 1968		10,100	491	491			42.0					
Jabal, 1962		8,100					36.0					
Majid, 1966		9,000-9,800					—					
Don Mansour Unit		5,600					—					
Nasser, 1959		5,500-7,600					38.0					
Lahb-Dor Marada Unit, 1985		9,500					50.0					
Raguba, 1961		5,400					43.0					
Beda, 1959		4,000					36.0					
Bustawn, 1972		6,000					40.0					
Dor, 1967		6,400					33.2					
Kofia, 1963		5,500					34.0					
Safabi B & D, 1961		9,000-10,000					38.0					
Sarif, 1961		9,000					37.2					
Amal, 1959		9,900					37.5					
Ors, 1962		7,250					40.2					
Ghani, 1978		6,000					40.0					
Bahi, 1968		3,500-3,750					43.4					
Betheden, 1962		7,000					33.6					
Dahra, 1959		3,100-3,700					37.0-41.0					
Dafa, 1969		5,400-5,900					35.6					
Gisto, 1961		2,200-6,300					36.7					
Harrin, 1978		7,400					34.8					
Khalifa, 1978		5,400-7,000					34.8					
Masrab, 1978		10,000					39.6					
Samah, 1961		9,000					33.4					
Waha, 1980		6,000					36.0					
Zagout, 1962		6,000					36.4					
Baist, 1983		5,100-5,400					38.2					
Al, 1975		3,800					1	2	50.0			
Ainss, 1975		4,000					5	8	49.5			
Intisar A, 1967		9,750					8	19	46.0			
Intisar B, 1974		9,800					2	2	50.0			
Intisar C, 1967		9,850					1	6	37.5			
Intisar D, 1967		9,400					19	27	38.0			
Intisar E, 1968		5,300-7,100					8	11	34.7			
Naloor-Augila, 1986		2,300-10,000					13	55	35.5			
Award, 1976		6,250					8	8	46.0			
Sabah, 1977		5,500					36	38	42.0			
Zalla, 1977		6,750					27	31	46.1			
Pidas, 1979		7,000					9	9	41.7			
Hakim, 1978		6,700					3	3	46.5			
Other		7,900-8,900					1	2	40.4			
Total Libya			712	799	1,374,080	17,463,986,933						

^(a)Prior to the conflict in the Persian Gulf.

PRODUCTION

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
				Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl	
MALAYSIA								
ESSO MALAYSIA		• Bekok, 1976	5,500	22	33	330,000	940,000,000	47.0
		• Gunkong, 1976	5,200	36	91			44.0
		• Irong Berat, 1979	3,300	9	18			35.0
		• Kapong, 1979	6,000	—	11			47.0
		• Pesisir, 1979	6,300	13	18			49.0
		• Puteh, 1973	4,300	22	32			42.3
		• Seligi, 1971	4,300	40	43			50.0
		• Semangok, 1980	3,700	31	41			42.5
		• Tabu, 1976	5,600	15	24			44.0
		• Tapis, 1975	6,700	41	80			45.0
		• Tinggi, 1980	4,400	21	27			46.0
		• Tiong, 1978	5,800	20	41			47.0
SARAWAK SHELL PETROLEUM (SSPC)		• Barton, 1971	2,400	4	4	10,411	16,400,000	37.0
		• Erb West, 1971	6,785	15	19	22,486	43,900,000	30.0
		• Ketam, 1977	4,800	1	4	274	1,300,000	30.0
		• Samarang, 1972	5,700	56	80	46,027	295,300,000	37.0
		• South Fumau, 1974	3,300	7	15	4,384	16,300,000	30.0
		• St. Joseph, 1975	2,200	11	14	37,534	47,000,000	32.0
SARAWAK SHELL BERHAD (SBB)		• Baysir, 1976	4,200	7	9	24,832	41,100,000	37.3
		• D-18, 1981	4,000	5	5	2,466	4,900,000	39.9
		• Tamana, 1972	3,100	19	29	13,151	49,300,000	35.0
PETRONAS CARIGAL ^(a)		• Tambung, 1971	6,000	8	16	131,355	825,126,600	40.0
SARAWAK SHELL/PETRONAS CAG ^(a)		• Baku	—	—	—			—
		• Beram	—	—	—			—
		• Baronia, 1967	7,900	19	40			42.0
		• Betty, 1967	7,900	13	17			38.0
		• Bokor, 1972	2,000	19	19			35.0
		• Farley Beram, 1973	6,655	—	2			39.5
		• Sias, 1973	4,100	4	4			25.0
		• Tukau, 1966	5,000	26	48			29.2
		• West Lutong	—	—	—			39.5
Total Malaysia				589	794	623,080	2,080,626,600	
MEXICO								
NORTH ZONE, FRONTERA NE		Mision, 1945	5,440	173				—
		Monterrey, 1950	6,510					42.4
		Tigrillo, 1971	3,342					—
		Cañon	—					—
		Comitas	—					—
NORTH ZONE, ALTAMIRA		Arenque, 1970	11,382	25,254				36.0
		Constituciones, 1956	6,350					17.0
		Ebano-Pánuco, 1901	1,450					12.0
		Tamaulipas	4,200					19.0
NORTH ZONE, CERRO AZUL		Chicontepec, 1973	4,284	16,853				—
		• Isla de Lobos, 1963	6,875					34.1
		• Merapi, 1974	10,198					40.0
		• Naranjos-C. Azul, 1909	1,800					34.0
		Tras Hermanos, 1969	6,960					27.0
NORTH ZONE, POZA RICA		• Atón, 1966	9,040	50,530				37.0
		• Bagre, 1973	10,919					33.0
		Eacolin, 1942	7,216					26.3
		Hellazgo, 1955	10,170					28.7
		Jilapa, 1956	7,380					35.6
		Mecatepec, 1941	7,544					29.8
		Miquetta, 1959	6,490					29.8
		Poza Rica, 1930	7,090					35.0
		Pres. Alemán, 1949	8,036					24.0
		Remolino, 1982	10,745					29.5
		San Andrés, 1966	10,410					29.0
NORTH ZONE, FAJA DE ORO		Acustampa, 1955	4,085	5,394				21.0
		Muro, 1965	3,986					17.0
		Ordóñez, 1952	5,220					21.0
		Ocotepac, 1963	3,737					20.9
		Santa Agueda, 1953	4,780					16.0
NORTH ZONE, VERACRUZ		Metapionche, 1974	11,129	5,394				—
		Angelina	—					36.9
		Copita	—					14.0
		Other	—					32.3
SOUTH ZONE, NANCHITAL		Ihuatán Ota, 1985	1,980	61,519				20.4
		Micosán, 1962	500					22.0
		Santa Rosa, 1952	1,312					25.4
SOUTH ZONE, AGUA DULCE		Agua, 1966	3,830	61,519				34.6
		Bacul, 1978	3,500					36.0
		Buastio, 1967	7,216					37.0
		Cinco Pres, 1980	6,962					32.0
		Concepcion, 1974	1,800					32.7
		Cuchapa, 1935	2,200					30.0
		El Plan, 1931	1,700					30.0
		El Burro, 1931	2,200					31.0

PRODUCTION

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
			Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl	
SOUTH ZONE, REFORMA	Lacmango, 1973	1,700					31.8
	Los Soldados, 1953	4,492					37.0
	La Venta, 1954	4,730					33.0
	Ogami, 1957	5,790					33.0
	Ostales, 1965	7,489					32.0
	Reclador, 1971	11,398					32.0
	S. Magafinas, 1957	4,240					30.0
	San Ramon, 1967	9,515					28.0
	Tonala, 1928	1,770	4,740	4,740		17,475,500,400	32.0
	Agave, 1977	13,450					43.1
	Amayo Zanapa, 1978	14,588					36.2
	Artesa, 1977	11,800					24.4
	Cacho López, 1977	14,250					29.0
	Cactus, 1973	14,100					36.0
	Carmelo, 1980	10,050					45.6
	Cartizo, 1962	3,500					23.3
	Concepcion, 1979	14,432					33.2
	Copero, 1977	11,880					47.3
	Chiapas, 1979	12,136					47.3
	Girardias, 1977	15,225			205,369		46.0
	Inde, 1974	13,775					28.5
	Ira, 1979	14,432					36.8
	Muspa, 1962	9,676					58.5
	Mundo Nuevo, 1977	11,800					49.3
	Nisero, 1974	14,100					37.7
	Palmar, 1978	15,900					31.2
	Rio Nuevo, 1975	14,950					35.6
	Samaria (Cret), 1973	14,208					31.0
SOUTH ZONE, COMALCALCO	Sito Grande, 1972	13,786					35.0
	Suncuapa, 1978	12,687					31.8
	Tapulapa, 1962	15,613					30.8
	Topen, 1978	11,172					39.6
	Artesa (Terc), 1984	...					28.0
	Samaria (Terc), 1965	4,820					13.9
	Ayapa, 1972	8,200					27.2
	Castanica, 1967	10,080					30.9
	Cunducan, 1974	13,775					27.6
	El Golpe, 1963	3,500					28.5
	Mora, 1981	...					36.1
	Onilacque	11,150			128,626		27.9
	Santuario, 1968	9,617					37.0
SOUTH ZONE, CARDENAS	Tintal, 1968	5,904					23.0
	Tupico, 1959	9,685					27.0
	Belota, 1962	17,056					36.8
	Capamoa, 1962	18,368					33.2
	Cardenas, 1979	17,548					36.0
	Eden, 1983	17,580					37.0
	Fanta, 1979	17,878			254,834		40.0
	Jolote, 1983	16,119					36.7
SOUTH ZONE, OCOBINGO	Jajo, 1980	17,548					34.0
	Paredon, 1979	15,680					36.8
	Tecominacan, 1983	19,519					33.2
	Fortuna Nacional	...					34.0
MARINE ZONE, CD. DEL CARMEN	Jose Colomo	...			174		34.0
	Vernet	...					34.0
	Centares, 1976	8,538					21.3
MARINE ZONE, DOB BOCAS	Ku, 1979	10,000			1,219,980		22.0
	Abkalun, 1978	11,800					27.6
MARINE ZONE, DOB BOCAS	Pol, 1979	12,800					39.0
	Chuc, 1982	13,100			573,728		35.0
	Itzac, 1974	...					29.9
Total Mexico			4,740	4,740	2,542,296	17,475,500,400	

MOROCCO

Essaouira, 1978	10,500	6	6	338	810,757	40.0
Rharb, 1951	4,580	6	6	586	4,214,173	...
Haricha, 1967	3,000	...	...	...	...	...
Sidi Phalem, 1982	6,288-7,186	...	...	...	12,430,288	...
Other	...	...	...	...	...	...
Total Morocco			12	12	986	17,485,196

MYANMAR(*)

CHINA	Chauk-Lanywa, 1902	1,500-4,000	480	480	13,080	904,300,000	36.0
	Mann, 1970	1,800-7,000					37.5
	Myingung, 1964	2,000-4,000					40.5
	Prome, 1965	850-5,000					36.0
	Yanggyaung, 1962	100-6,700					36.0
Total Myanmar			480	480	13,080	904,300,000	

PRODUCTION

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
			Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl	
NETHERLANDS	UNOCAL • Haven, 1980	5,300	2	2	4,046	1,644,075	25.5
	• Helder, 1980	4,900	12	15	4,468	23,266,028	21.6
	• Helm, 1979	4,400	7	9	1,593	8,627,041	17.9
	• Hoon, 1981	5,000	7	8	3,482	22,214,299	25.8
	MIAM Berlat, 1954	...	17	17	3,811	8,008,000	32.1
	DeLier, 1955	5,200	22	33	805	17,341,000	33.2
	Jeelmonds, 1956	...	59	86	3,838	93,819,000	26.8
	Meerkapelle, 1955	...	...	...	2,049	746,000	28.6
	Pernis West, 1967	...	...	...	...	82,000	28.2
	Pinacker, 1955	...	4	5	307	6,460,000	36.3
	Rotterdam, 1964	...	2	2	4,126	5,221,000	30.5
	Schoonebeek, 1944	2,500	...	495	7,737	241,151,000	12.3
	Werkendam, 1956	...	...	...	16	256,000	33.0
	Zoetermeer, 1957	3,200	30	30	764	10,811,000	16.5
	CONOCO • Kottar, 1980	6,500	7	11	20,320	44,632,137	33.0
	• Logger, 1982	6,500	5	9	8,945	19,276,989	33.5
	AMOCO • Rijn, 1982	6,600	13	28	4,320	18,774,817	35.0
	Total Netherlands		187	788	70,347	529,388,386	
NEUTRAL ZONE	AOC • Hout, 1981	4,900-6,800	21	34	3,900	66,130,000	33.0
	• IZ-9, 1981	4,400-7,300	135	165	229,580	2,849,320,090	28.2
	TEXACO & KOC • S. Fawaris, 1983	6,300	5	9	...	...	25.0
	• S. Umm Gudair, 1986	8,900	16	17	78,540	1,812,607,100	24.3
	Wafra, 1953	1,100-7,000	322	427	...	...	18.9-23.5
	Total Neutral Zone		499	662	312,000	4,728,057,186	
NEW ZEALAND	SHELL-SP-TODD • Kapuni, 1959	11,700	11	14	...	...	54.0
	• Maui, 1969	11,000	14	14	...	...	51.0
	PCNZ Ahuroa, 1967	8,688	...	1	...	...	46.1
	Kaimiro, 1982	11,900	2	2	38,000	110,726,300	42.0
	McKee, 1980	7,848-8,251	19	22	...	...	38.5
	Tariki, 1986	9,065	...	1	...	...	52.7
	Wahepa, 1988	10,125-10,643	5	6	...	...	36.6
	Total New Zealand		51	69	38,000	110,726,300	
NIGERIA	AGIP • Abigara, 1981	7,500-12,000	16	16	25,774	13,547,026	36.2
	Agwa, 1975	10,800	1	2	408	2,307,927	44.0
	Akri, 1967	9,600-10,600	6	11	8,814	64,407,651	40.8
	Akri W., 1972	9,900-10,200	...	2	...	482,258	...
	Ashaka, 1968	9,700-12,000	1	1	1,011	3,344,888	37.4
	Azuuama, 1975	8,700-14,800	2	2	1,268	463,258	34.1
	• Beniboye, 1978	9,000-10,000	9	9	6,433	16,668,435	28.6
	Beniku, 1974	12,000	1	2	129	3,407,816	14.8
	Clough Creek, 1976	10,000-12,400	9	9	9,318	28,799,764	25.5
	Ebegoro, 1975	11,500-12,000	6	9	6,197	86,771,341	37.1
	Ebocha, 1965	8,000-10,900	10	18	8,836	116,662,582	36.3
	Idu, 1973	7,750-10,700	...	10	...	23,862,581	...
	Kwale, 1967	10,000-11,500	6	8	8,370	13,274,523	37.1
	Mbade, 1966	7,300-8,400	10	18	12,589	172,997,990	43.1
	Obama, 1973	11,600-14,300	6	8	14,877	108,476,448	30.7
	Obiafu, 1967	9,300-12,200	16	26	19,249	98,996,243	41.8
	Obirikom, 1967	8,000-10,000	8	14	6,981	58,785,580	43.4
	Odughi, 1972	12,500	1	2	1,710	10,946,737	49.9
	Ogbogere, 1972	10,000	...	2	...	3,302,783	...
	Ogbogere W., 1982	13,000	...	1	...	353,136	...
	Okpai, 1988	10,000-12,000	8	8	4,587	22,272,119	42.8
	Omoku W., 1974	11,500	1	1	945	5,227,184	40.0
	Oshi, 1972	9,600-11,300	10	11	13,137	75,880,065	35.2
	Taylor Creek, 1986	8,300-10,400	1	1	3,197	1,692,976	37.3
	Tobidaba, 1972	10,300-11,300	7	10	15,901	130,095,927	30.4
	Umuru, 1977	14,100	2	4	2,356	7,053,937	40.3
	ELF • Aghio, 1972	7,300	18	21	6,874	25,900,000	24.8
	Erema, 1972	11,211	3	6	6,240	13,200,000	24.6
	Obagi, 1964	8,377	55	74	55,384	386,900,000	24.6
	Obodo-Jelum, 1966	...	16	17	18,471	75,000,000	24.8
	Opoko, 1967	8,745	16	17	6,750	34,600,000	24.8
	Upomani, 1965	8,256	11	14	4,804	18,400,000	24.8
	GULF NIGERIA • Abitaya, 1970	5,750-8,400	12	18	6,786	68,620,894	39.7
	• Delta, 1965	5,800-8,500	22	27	18,348	163,649,519	37.3
	• Delta South, 1965	7,100-10,179	20	39	33,748	264,165,950	38.4
	• Isen, 1970	5,800-8,000	8	11	1,948	44,227,300	40.4
	Jake, 1973	6,300-7,600	3	6	1,041	7,288,105	41.1
	Makaraba, 1973	7,100-12,000	23	28	24,294	109,307,887	27.7
	• Maku, 1969	4,800-6,300	13	18	15,585	114,238,427	40.4
	• Meta, 1965	8,570-12,000	4	5	6,891	26,261,982	38.1
	• Miji, 1985	5,300-10,900	26	29	18,317	164,923,786	31.9

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
		Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl	
• Merari, 1965	5,000-7,500	37	58	58,427	536,009,957	31.9
• Mina, 1965	...	3	3	4,730	3,975,460	40.3
• Oken, 1964	5,500-9,245	55	70	42,108	471,062,427	38.1
• Parabe-Eko, 1966	4,500-8,200	17	28	10,115	110,709,877	40.4
• Robertini, 1964	11,484-13,190	11	13	20,878	27,301,921	40.2
• Tapa, 1978	8,150-10,842	8	10	9,840	34,846,887	39.5
• Utonana, 1971	7,400-9,165	3	5	629	8,599,272	20.4
• W. Isan, 1971	7,825-10,229	5	9	2,389	36,136,036	40.4
• Yorle South, 1974	11,389-12,635	...	2	...	822,618	41.0
TEXACO-CHEVRON-HMPC						
• Funtua, 1978	5,000-7,000	20	25	19,386	57,447,072	36.5
• Middleton, 1972	5,000-7,000	3	7	2,137	17,407,040	36.3
• North Apoi, 1973	4,000-8,100	25	28	34,706	189,057,507	36.5
• Pennington, 1965	5,000-10,100	2	9	2,348	28,733,949	36.5
• Sengana, 1967	11,400-12,600	...	2	...	666,102	46.7
MOBIL						
• Adia, 1967	6,970	7	11	10,664	55,007,899	34.8
• Asabo, 1966	5,600	9	27	16,482	173,832,194	34.6
• Asabo "D", 1979	7,621	1	2	1,199	3,186,472	34.6
• Ata, 1964	8,823	...	5	...	433	...
• Edop, 1966	9,215	1	9	38,905	33,368,719	37.4
• Ekpe, 1966	8,200	10	22	14,222	198,798,729	34.9
• Ekpe-WW, 1977	6,810	2	6	6,036	40,310,161	31.9
• Eku, 1966	5,420	3	14	2,487	18,375,442	30.4
• Enang, 1968	6,600	18	38	17,261	144,339,212	37.4
• Etim, 1968	6,200	7	18	17,972	125,688,898	37.1
• Idoho, 1966	9,020	3	7	826	29,559,880	30.5
• Inim, 1966	5,850	7	14	12,432	154,868,705	37.5
• Isabo, 1968	7,345	3	7	14,841	14,358,750	30.4
• Isak S.E., 1979	7,441	6	7	18,077	54,999,641	36.6
• Mfem, 1968	5,200	2	5	4,876	26,886,881	36.1
• Ubit, 1968	5,400	30	55	39,586	210,098,065	36.1
• Uhin, 1967	5,180	7	15	10,782	52,159,220	33.3
• Usari, 1965	8,431	...	4	...	6,885	...
• Utue, 1966	5,700	5	14	10,901	77,619,051	38.6
PAN OCEAN						
• Ogharefe, 1973	9,900	7	18	1,158	29,669,008	46.6
DUBRIL						
• Gili-Gili, 1967	9,357	3	7	906	1,137,867	47.1
SHELL						
• Adibawa, 1966	11,950	11	27	12,052	86,987,584	23.4
• Adibawa N.E., 1972	10,663	3	4	3,968	18,574,667	25.3
• Alam, 1966	6,000	8	22	2,287	61,356,325	45.0
• Alam Umu, 1957	10,024	...	4	...	2,378,685	...
• Alisara, 1966	8,500	29	35	11,844	125,204,182	19.0
• Atremo, 1972	9,263	10	15	15,908	18,077,037	36.8
• Agbada, 1960	10,000	29	53	19,611	196,223,121	23.9
• Ahia, 1965	11,561	5	13	4,099	86,370,285	38.2
• Ajokpori, 1967	11,139	1	5	527	5,848,952	39.3
• Ajuju, 1970	13,324	1	5	971	10,304,503	34.7
• Akaso, 1979	13,122	2	3	1,432	4,293,092	37.1
• Akpor, 1965	10,149	...	3	...	1,833,106	...
• Akube, 1967	10,434	1	1	254	4,486,154	22.7
• Alakin, 1959	10,169	12	26	7,430	70,945,576	44.5
• Amukpe, 1970	11,459	2	3	1,198	13,591,898	41.7
• Apara, 1960	9,000	3	10	3,799	29,300,026	38.4
• Asea, 1961	9,738	2	4	1,080	5,949,721	20.6
• Bodo East, 1962	9,700	9	12	4,216	83,991,568	27.1
• Batin, 1968	11,000	9	10	7,777	80,320,288	21.7
• Benisade, 1973	8,941	15	22	34,325	127,045,999	21.9
• Bomu, 1956	7,000	6	49	6,146	359,457,322	37.3
• Bonny, 1959	12,254	7	23	4,303	83,146,273	32.6
• Buguma Creek, 1960	12,496	4	10	2,184	14,109,744	37.6
• Cawthorne Chan, 1963	11,000	21	40	47,581	314,445,240	36.9
• Disbu Creek, 1968	13,119	7	15	9,753	112,470,475	40.3
• Ebubu, 1958	9,411	3	10	206	18,883,643	21.2
• Egert, 1967	9,350	18	29	16,944	146,784,895	34.1
• Egbema, 1960	8,731	6	8	3,120	56,520,126	33.1
• Egbema W., 1965	9,096	6	19	5,146	83,710,410	41.2
• Elukema, 1958	10,483	21	33	44,882	231,433,712	31.6
• Elelenes, 1960	11,000	6	18	3,716	35,118,812	35.8
• Enwa, 1965	10,170	...	8	...	2,611,679	...
• Etalebou, 1971	12,000	8	11	14,529	132,206,501	31.3
• Eriemu, 1961	12,500	13	18	5,372	47,657,877	20.8
• Escravos Beach, 1969	8,178	9	14	12,344	86,425,461	31.2
• Ewewi, 1967	10,900	7	11	4,018	39,342,474	25.6
• Forcados Yorki, 1969	10,869	56	124	53,582	580,642,984	24.4
• Igwe, 1966	...	3	...	437,017	...	...
• Ino River, 1969	7,900	37	57	47,017	498,674,807	30.3
• Isimi, 1964	8,450	1	8	391	36,370,370	26.3
• Isoko, 1960	12,479	4	6	2,388	7,099,085	29.8
• Jonas Creek, 1967	8,000	29	36	37,541	423,877,585	29.7
• Kalakute, 1972	9,236	5	12	13,325	13,796,014	40.5
• Kolo Creek, 1971	12,000	17	38	20,891	144,265,152	38.1
• Kolori, 1961	8,900	25	32	19,387	322,186,233	39.9
• Korokoro, 1969	10,222	8	9	3,391	85,541,415	35.8

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, R	No. of wells		Production		*API gravity
		Producing	Total	1990 average b/d	Cumulative to Dec. 31, 1990 bbl	
Krakama, 1958	9,890	3	13	1,982	18,773,262	22.9
Nembe Creek, 1973	12,213	39	49	96,776	285,191,169	31.0
Nkai, 1963	12,000	4	12	3,510	31,860,205	39.2
Nun-River, 1960	14,200	4	12	2,244	33,569,371	32.7
Oben, 1972	12,036	17	28	16,533	134,469,258	37.6
Obeskp, 1975	8,274	2	5	2,983	19,318,618	26.3
Obele, 1964	10,040	...	5	...	4,721,597	...
Obigbo	...	...	...	...	396,727	...
Obigbo North, 1963	8,250	28	47	12,142	183,246,416	23.16
Odeama Creek, 1981	12,897	5	6	21,632	35,066,963	35.5
Odidi, 1967	10,980	34	44	46,405	239,265,369	36.2
Ogini, 1964	5,860	8	25	3,977	24,841,774	18.2
Oguta, 1965	10,300	13	28	10,622	136,391,390	43.2
Olororo, 1963	8,500	20	33	16,609	292,362,412	21.5
Onna, 1965	10,384	3	3	928	10,146,086	35.3
Opuama, 1972	9,214	2	7	2,498	27,407,327	43.7
Opobo South, 1974	9,849	3	10	4,092	21,782,134	43.7
Opukushi, 1962	7,623	12	18	25,222	133,578,606	28.3
Opukushi North, 1977	11,100	1	4	89	2,823,783	35.6
Orobin, 1956	10,367	...	18	...	20,061,673	...
Oroni, 1964	12,000	6	8	2,495	27,823,535	22.6
Orubiri, 1971	9,700	1	11	3,586	19,429,768	38.2
Osoka, 1967	11,721	2	4	869	7,820,325	26.2
Otamini, 1973	9,440	3	8	1,246	15,021,319	21.0
Otumara, 1969	8,176	26	32	46,204	186,341,053	24.9
Oweh, 1964	12,300	9	11	5,944	96,666,011	25.8
Oza	...	...	...	...	1,006,373	...
Rapele, 1965	11,627	1	6	484	23,188,706	44.0
Rumuekpe, 1961	11,016	2	4	1,978	2,551,316	29.3
Saghara, 1970	8,590	5	8	7,152	37,421,364	31.8
Sapele, 1969	12,786	6	23	10,725	122,119,031	42.9
Soku, 1958	11,500	16	25	9,563	118,849,660	27.7
Tai, 1965	10,367	2	3	799	5,179,269	38.3
Ube, 1961	14,380	5	10	5,078	34,889,280	27.6
Ughada, 1966	8,618	1	2	80	1,094,622	37.7
Ughelli East, 1959	11,800	6	14	2,803	91,534,784	38.9
Ughelli West, 1960	8,800	9	14	7,260	37,854,301	20.5
Umuchem, 1959	8,250	8	23	4,510	151,464,846	37.2
Utapat South, 1974	10,497	8	12	9,005	42,591,450	38.5
Ulorogu, 1964	9,000	17	30	8,454	136,204,387	26.8
Uzere East, 1960	8,500	10	15	6,119	92,598,622	28.6
Uzere West, 1963	8,500	11	11	5,803	103,685,793	25.4
Wam River, 1961	12,264	2	5	1,234	15,816,865	29.8
Yoris, 1970	11,917	10	16	6,629	64,229,584	39.2
Yoris South, 1979	12,190	...	2	...	822,674	...
ASHLAND • Adanga, 1980	14,096	7	19	11,376	24,560,874	32.1
• Akam, 1980	6,700	5	13	5,735	21,644,440	35.6
• Bogi, 1989	8,256	2	4	2,002	1,294,064	23.2
• Ebughu, 1984	7,250	3	4	906	911,781	28.0
• Izombe, 1974	9,500	8	32	10,196	57,595,735	37.8
• Mimbo, 1984	7,973	2	5	5,586	2,593,080	30.7
• Oseu, 1974	8,905	7	9	843	5,570,639	40.7
• Ukpem, 1989	7,425	1	2	1,695	1,564,018	40.6
TENNECO Abura, 1979	13,471	2	5	1,875	17,932,485	44.7
Total Nigeria		1,574	2,754	1,810,913	13,708,230,638	

NORWAY

AMOCO • Hod, 1974	8,860	5	5	27,489	10,817,021	34.0
• Valhall, 1975	8,200	23	26	64,972	178,725,234	35.0
BP • Gyda, 1981	13,123	7	11	25,788	9,415,770	48.0
• Ula, 1976	11,800	8	14	94,915	132,490,825	44.6
CONOCO • Murchison*, 1975	9,900	21	34	8,114	63,656,330	38.0
NORSK HYDRO • Oseberg, 1979	7,500	11	15	300,000	198,000,000	34.0
PHILLIPS • Albuskjell, 1972	10,400	7	19	3,498	43,439,601	45.0
• Cod, 1968	9,500	6	8	800	15,951,706	55.0
• Edda, 1972	10,480-10,600	7	7	4,098	24,218,952	41.5
• Ekofek, 1968	10,000	40	50	154,397	987,783,127	41.1
• Eldfak, 1970	9,350-10,000	37	39	59,600	283,921,186	41.1
• Tor, 1970	10,000	12	13	7,200	113,065,169	38.0
• West Ekofek, 1970	10,300	7	13	1,900	72,244,461	43.9
STATOIL • Gullfaks, 1978	9,500-9,700	39	54	255,556	270,595,800	29.3
• Statfjord, 1974	9,500	68	100	574,073	1,979,818,152	38.2
• Tommeliten, 1976	10,400	6	6	11,906	10,573,277	47.0
• Vestefakk, 1981	10,100	8	11	49,518	18,038,588	...
Total Norway		308	425	1,643,808	4,412,735,219	

*Norway share (22.2%) of total production.

OMAN

PDO Al Burj, 1987	8,890	6	7	8,219	3,000,000	28.0
Al Ghubar, 1978	1,916	3	6	8,219	10,000,000	29.0
Al Hwasah, 1969	5,320	43	47	16,438	183,000,000	39.0

PRODUCTION

WORLDWIDE PRODUCTION

WORLDWIDE PRODUCTION				Production		*API gravity	
Name of field, discovery date	Depth, ft	No. of wells		1990 average b/d	Cumulative to Dec. 31, 1990 bbl		
		Producing	Total				
Alam, 1967	...	...	...	2,740	1,000,000	33.0	
Amal, 1977	...	34	39	8,219	14,000,000	19.0	
Amal S, 1982	...	...	...	2,740	6,000,000	30.0	
Anzaiz, 1974	7,088	4	4	5,479	10,000,000	46.5	
Bahja, 1984	5,697	10	12	13,699	18,000,000	47.2	
Bank, 1978	8,856	3	3	2,740	4,000,000	47.4	
Fahud, 1963	2,499	153	235	57,534	815,000,000	32.0	
Fahud West, 1965	...	...	...	2,740	1,000,000	34.0	
Ghaba North, 1972	2,227	14	25	2,740	56,000,000	33.5	
Habur, 1975	5,800	1	2	13,699	5,000,000	15.0	
Hassrah, 1984	8,708	10	12	8,219	10,000,000	48.8	
Ihsan, 1984	5,578	5	6	2,740	2,000,000	23.5	
Jaimud, 1979	4,236	3	3	2,740	1,000,000	24.0	
Jawdah, 1984	3,570	6	7	2,740	3,000,000	29.5	
Karim W., 1982	3,546	26	27	13,699	24,000,000	23.0	
Kaukati, 1983	8,282	1	1	2,740	2,000,000	31.0	
Lekhwair, 1974	4,352	47	83	24,656	84,000,000	37.5	
Marmul, 1977	5,087	169	185	32,877	149,000,000	21.5	
Narh, 1983	4,788	36	68	24,658	369,000,000	33.4	
Nimr, 1980	3,296	117	119	41,096	53,000,000	21.0	
Qaharir, 1978	4,536	27	32	8,219	29,000,000	30.4	
Qarat Al Mith, 1973	4,936	...	...	2,740	1,000,000	29.0	
Qata, 1979	4,707	11	16	2,740	6,000,000	28.0	
Quhair East, 1978	...	2	4	2,740	1,000,000	25.5	
Rahab, 1978	3,237	21	28	2,740	9,000,000	25.0	
Rajaa, 1988	...	...	...	2,740	1,000,000	50.0	
Ramlat Rizek, 1987	2,720	1	1	5,479	2,000,000	37.0	
Rima, 1979	3,247	47	48	71,233	179,000,000	33.0	
Rumh, 1978	3,215	10	10	2,740	4,000,000	21.1	
Sah Niheyda, 1972	8,700	21	28	24,658	178,000,000	39.6	
Sah Rawi, 1973	9,826	14	24	8,219	97,000,000	39.0	
Sayyala, 1982	3,690	14	14	32,877	50,000,000	50.1	
Shibkuh, 1988	2,591	...	2	2,740	1,000,000	29.0	
Simsim, 1985	5,250	11	12	5,479	7,000,000	30.6	
Suwaihat, 1982	6,452	10	10	5,479	18,000,000	37.5	
Thamoud, 1987	3,773	...	...	2,740	1,000,000	23.0	
Thuleilat, 1980	...	14	15	2,740	4,000,000	25.5	
Wafra, 1983	5,510	7	8	5,479	6,000,000	38.8	
Warad, 1985	4,922	5	5	2,740	2,000,000	22.0	
Yibal, 1983	8,465	194	206	164,384	782,000,000	38.5	
Zahra, 1986	6,562	5	5	2,740	2,000,000	32.0	
Zareef, 1985	3,264	10	11	13,699	15,000,000	47.0	
Zauliyah, 1981	8,177	10	14	5,479	17,000,000	44.3	
Zumrud, 1988	...	...	...	2,740	1,000,000	29.0	
OCCIDENTAL	Selah, 1983	6,500	100	111	24,142	24,607,013	42.0
ELF GROUP	Ramlat	...	1	1	53	167,360	46.0
	Sahmah, 1978	12,400	11	11	5,127	28,351,500	46.0
Total Oman		1,237	1,487	714,253	3,286,125,873		

PAKISTAN

PAKISTAN OILFIELD LTD.	PAKISTAN ^(a)	Belkassar, 1946	9,398	4	17	26.0
		Dhulan, 1936	8,899	12	49	48.0
		Meyat, 1968	12,513	6	6	41.3
		Joya Meir, 1944	6,900	2	4	15.0
		Kheir, 1915	9,306	13	397	33.0
PAKISTAN PETROLEUM LTD. ^(a)		Adhi, 1978	9,452-9,813	5	5	51.0
	OQDC ^(a)	Bibi, 1988	9,515-7,897	3	3	52.0
		Chak-Naurang, 1986	9,187	3	4	12.1
		Finkassar, 1982	11,465	1	1	29.4
		Ghotana, 1986	7,300	1	1	41.1
UNION TEXAS ^(a)		Lashari Centre, 1988	6,916	1	1	44.2
		Pasehki, 1989	7,153	1	1	43.0
		Sono, 1988	7,618	3	4	40.5
		Tando Alam, 1984	6,890-7,448	4	10	41.7
		Thora, 1987	7,548	5	5	42.2
OCCIDENTAL		Toot, 1988	15,135	5	14	39.0
		Debhi, 1984	5,594	2	4	42.0
		Kheskeli, 1981	3,387	4	11	38.0
		Laghari, 1983	2,584	4	7	42.0
		Mazari, 1985	3,888	5	5	43.0
OCCIDENTAL		South Mazari, 1985	3,820	2	4	43.0
		Other	...	7	8	31.0-48.0
		Bhangali, 1989	12,650	1	1	32.5
Total Pakistan		Dhumal, 1984	13,100	3	6	38.0
				97	588	62,988
						221,736,186

PERU

PETROMAR S.A.	e Litoral, 1955	1,500-6,000	91	134	1,925	36,858,380	36.0-40.0
	e Lobitos, 1980	3,500-7,500	137	278	9,554	58,278,603	38.0
	e Puna Negra, 1980	3,000-8,500	147	306	7,909	115,445,788	38.0

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
		Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl	
• Providencia, 1967	3,000-7,000	45	93	1,831	22,550,885	38.0-40.0
Other	...	2	24	54	31,541	...
OCCIDENTAL						
Barra, 1979	8,000-8,900	14	18	5,306	21,152,135	11.8
Capehuan Sur, 1973	11,800-12,900	15	27	7,116	137,405,946	33.7
Donsa, 1978	9,800-10,600	5	13	7,386	42,117,699	32.0
Forestal, 1973	9,000-9,900	8	12	6,177	36,586,174	18.5
Huayun Sur, 1977	10,000-10,800	9	12	3,451	20,765,040	28.5
Jibaro, 1981	9,000-9,650	2	5	5,053	15,031,355	10.5
Jibaro, 1974	10,110-10,155	5	6	3,071	9,451,666	10.6
San Jacinto, 1978	7,200-9,760	9	22	5,831	33,219,653	14.9
Shiviyacu, 1973	8,100-10,100	19	27	17,908	78,133,229	20.3
Other	...	2	13	2,157	3,094,912	21.3
OCCIDENTAL/BRIDAS						
Talara area, 1975	1,343-6,080	761	1,101	5,963	50,797,833	34.8
PETROPERU						
Agua Caliente, 1939	1,000-15,000	7	12	119	14,416,391	42.0
Caprona, 1972	9,800-12,000	1	5	407	3,891,327	25.0
Comeries, 1971	10,000-12,600	28	36	16,709	107,634,867	24.9
Maquia, 1957	2,100-2,400	19	29	1,850	13,610,702	37.5
N. Esperanza, 1980	10,200-10,700	...	3	498	5,752,323	42.5
Pacaya, 1983	...	...	3	...	52,397	...
Pavayacu, 1972	9,800-11,300	9	14	2,527	18,381,009	29.5
Selva Central	...	...	...	...	...	36.0
Talara-Lima area, 1969	2,000-9,000	1,958	6,154	18,856	986,866,673	32.3
Valencia, 1975	10,500-11,200	...	2	...	546,548	43.0
Yanayacu, 1974	11,400-13,600	6	8	752	4,779,917	18.8
Total Peru		3,299	8,356	131,430	1,823,132,976	

PHILIPPINES

ALCORN	• Galoc, 1981	7,260-7,260	...	1	...	383,460	37.2
PHILIPPINES	• Matinloc, 1978	6,656-6,750	3	5	815	10,162,235	43.8
	• Nido, 1977	6,576-6,685	3	5	565	16,262,931	27.1
	• North Matinloc, 1987	6,830-7,021	3	3	2,107	1,692,091	43.2
ALCORN PALAWAN	• Cadiao, 1977	5,734-5,881	2	2	1,235	10,897,569	45.6
TRANS-ASIA OIL & MINERAL	• South Tara, 1987	4,335-4,436	...	1	45	221,408	40.4
Total Philippines			11	17	4,787	38,619,884	

QATAR

QGPC	• Bui Hanine, 1970	6,000	20	35	127,793	621,534,316	35.0
	Dukhan, 1940	6,500	182	237	217,435	2,647,267,520	41.1
	• Idd El Shargi, 1960	4,500-6,250	17	42	9,969	207,075,108	35.0
	• Maydan-Mahzam, 1963	7,000	19	41	50,410	790,017,582	38.0
Total Qatar			238	355	405,637	4,466,894,526	

RAS al KHAIMAH^(a)

RAKOPET	• Saleh, 1983	14,500	7	7	750	12,775,000	50.0
Total Ras al Khaimah			7	7	750	12,775,000	50.0

SAUDI ARABIA^(a)

ARAMCO	Abqaiq, 1940	6,890					37.0
	Abu-Hadriya, 1940	9,340					35.0
	Abu Jifan	...					...
	• Abu-Safah, 1963	6,800					30.0
	Bahr	...					...
	• Bern, 1964	8,300					32.0-34.0
	Dammam, 1938	4,800					35.0
	Dhib	...					...
	Dibdibh	...					...
	Duhul	...					...
	El Hebe	...					...
	Fadhli, 1949	8,050					38.0
	Farrah	...					...
	Faridah	...					...
	Ghawar, 1948	6,820					34.0
	Habari	...					...
	• Hamur	...					...
	Hermalyah, 1971	8,430					36.0
	• Harqus	...					...
	• Hasbah	...					...
	Jaham	...					...
	Jaladi	...					...
	• Jana	...					...
	Jauf	...	1,235	1,235	6,267,800	88,618,621,094	...
	Jawb	...					...
	Juraybi	...					...
	• Jurayd	...					...
	• Karan	...					...
	Khurais, 1957	5,200					33.0
	Khursaniyah, 1956	6,580					31.0
	• Kurayn	...					...
	• Lameh	...					...

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
		Producing	Total	1990 average b/d	Cumulative to Dec. 31, 1989 bbl	
Lughish.....	...	...	...	...	...	...
• Maharah.....	...	...	...	...	...	...
• Marifa, 1957.....	7,950	...	...	...	...	33.0
• Marjan, 1957.....	6,800	...	...	...	...	...
Mazali.....	...	...	...	...	...	...
Qatif, 1945.....	7,100	...	...	...	...	33.0-34.0
Qirdi.....	...	...	...	...	...	...
• Ribyan.....	...	...	...	...	...	...
Rimtham.....	...	...	...	...	...	...
• Safaniya, 1951.....	5,100	...	...	...	...	27.0
Sahba.....	...	...	...	...	...	...
Samin.....	...	...	...	...	...	...
Sharar.....	...	...	...	...	...	...
Suben.....	...	...	...	...	...	...
Tinet.....	...	...	...	...	...	...
Waf'ah.....	...	...	...	...	...	...
Wetben.....	...	...	...	...	...	...
• Zukuf, 1965.....	5,800	...	...	...	...	32.0
Total Saudi Arabia.....		1,235	1,235	6,257,500	59,618,821,094	
SHARJAH AMOCO Saja and Mowayid ^(C) , 1980.....	10,200-12,300	16	16	22,560	129,667,200	50.0
CRESCENT ^(a) • Mubarak, ^(C) 1972.....	12,650	4	4	5,000	101,275,000	50.0
Total Sharjah.....		20	20	27,560	234,942,200	
SPAIN SHELL ESPANA • Amposta Marino Norte, 1970.....	10,000	...	8	...	55,667,000	37.0
• Terraco (Castellon BS/6), 1973.....	9,000	...	3	...	14,547,000	35.0
CHEVRON Ayokengo, 1964.....	4,600-5,200	35	43	582	15,592,664	37.0
REPSOL • Angula, 1984.....	12,600	...	1	...	...	44.0
• Casablanca, 1975.....	8,900	7	9	13,487	100,344,916	33.0
• Dorada, 1975.....	6,700	...	4	...	17,843,906	21.5
• Gavioles ^(C) , 1980.....	8,300	2	3	2,111	3,043,131	52.7
• Salmonsie, 1984.....	12,600	...	1	...	...	44.0
Total Spain.....		44	72	16,180	207,938,617	
SURINAME STAATSOLIE Tambaredjo, 1981.....	1,050	153	153	3,935	6,297,277	15.9
Total Suriname.....		153	153	3,935	6,297,277	
SYRIA AL FURAT OIL CO. (SHELL) Al Ishara East, 1966.....	...	...	...	7,397	8,100,000	38.1
Al Kharata East, 1966.....	...	...	...	622	900,000	37.5
El Ahmar, 1966.....	...	...	...	4,384	6,100,000	34.8
El Isba, 1968.....	...	...	...	15,068	8,200,000	37.0
El Ward North, 1968.....	...	...	...	26,027	24,000,000	38.1
Jarmof, 1969.....	...	...	...	1,918	700,000	39.0
Jido, 1966.....	...	...	...	1,370	3,100,000	35.0
Malch, 1960.....	...	...	...	274	100,000	34.0
Omar, 1967.....	...	...	...	18,356	21,100,000	41.5
Omar North, 1969.....	...	...	...	7,945	3,300,000	45.0
Ratka, 1963.....	...	...	...	5,479	2,000,000	34.5
Saban, 1969.....	...	...	...	6,027	2,200,000	40.0
Serhit, 1968.....	...	...	...	2,740	1,100,000	41.0
Shahat, 1968.....	...	...	...	6,849	3,000,000	40.5
Shdeha, 1969.....	...	...	...	4,110	1,500,000	35.0
Sijen, 1969.....	...	...	...	28,219	10,400,000	35.0
Tanak, 1967.....	...	...	...	20,822	11,100,000	36.5
Tayyari East, 1968.....	...	...	...	8,493	5,800,000	36.0
Thayyem, 1963.....	...	...	...	79,726	112,700,000	36.5
S.P.C. ^(a) Allen, 1974.....	5,900	25	37	...	...	19.0
Gbebeh, 1976.....	2,300	54	75	...	...	18.0
Jebeseh, 1966.....	2,000-3,300	132	219	...	...	18.0
Karachok, 1966.....	6,500	103	119	141,973	1,193,315,220	20.0
Rumilan, 1962.....	6,500	59	66	...	...	24.0
Soudie, 1959.....	6,500	532	579	...	...	24.0
Tichrine, 1976.....	2,600	58	73	...	...	18.0
Total Syria.....		983	1,168	388,000	1,418,515,228	
THAILAND UNOCAL • Banpot ^(C) , 1980.....	7,000	19	30	1,172	3,124,380	54.0
• Errewen ^(C) , 1973.....	7,000	86	165	7,919	22,291,090	54.6
• Kaphong ^(C) , 1974.....	8,000	18	24	2,640	5,293,680	56.0
• Plalong ^(C) , 1976.....	8,500	20	49	1,526	7,148,380	58.1
• Satun ^(C) , 1980.....	8,500	62	66	5,951	10,158,570	55.1
• South Satun ^(C) , 1980.....	...	16	22	198	72,180	54.0
THAI SHELL Sirtit, 1981.....	5,289-5,976	67	103	...	...	19.0
Prui Krathiem, 1984.....	4,200	1	2	22,759	50,477,850	41.0
Pratu Tao, 1981.....	...	1	1	...	...	41.0
Sirtit West, 1983.....	5,900	...	...	...	...	41.0

PRODUCTION

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells		Production		*API gravity
			Producing	Total	1990 average b/d	Cumulative to Dec. 31, 1990 bbl	
	Thap Reet, 1989	11,100	...	...			41.0
	Wat Taen, 1988	7,790	...	...			37.0-40.0
	Total Thailand		299	484	42,165	94,554,120	
TRINIDAD AND TOBAGO	AMOCO • Cassia, 1973	12,700	9	9	3,801	15,499,000	...
	TRINIDAD • Mora, 1982	8,500	2	2	254	821,000	...
	OIL CO. • Poui, 1974	11,650	38	40	18,609	171,384,000	...
	LTD. • Samaan, 1971	11,780	37	47	13,050	189,511,000	...
	• Teak, 1969	15,191	60	71	39,614	265,571,000	...
	TRINIDAD & Area IV and Guapo, 1963		85	192			...
	TOBAGO • Barrackpore, 1911	11,100	83	379			...
	OIL CO. LTD. • Brighton, 1903	7,500	59	620			...
	(TRINTOC) • Catalill, 1950	9,693	31	134			...
	• Forest Reserve, 1913	11,000	289	2,042			...
	• Grand Ravine, 1929	11,000	51	168			...
	• Gueyaguyare, 1902	10,750	115	899			...
	• Oropouche, 1944	9,100	29	128			...
	• Palo Seco, 1929	12,700	77	939			...
	• Parrylands 1-5, 1913	10,626	118	508			...
	• Penal, 1936	11,067	78	289			...
	• Point Fortin C & W, 1907	10,626	124	551	75,663	1,911,965,000	...
	• Trinity, 1956	9,700	20	95			...
	• Other		63	813			...
	TRINIDAD NORTHERN • Fortin Offshore (FOS), 1954		12	35			...
	AREAS (TNA) • Soldado, 1955	11,000	371	673			...
TRINIDAD & TOBAGO PETROLEUM CO. LTD. (TRINTOPEC) (e)	• Centari Los Bajos, 1973		162	221			...
	• Coora/Quarry, 1936	14,000	151	736			...
	• Fyzabad/Apex/Quarry, 1920-36	11,000	300	1,042			...
	• Galeota, 1963	6,304	47	105			...
	• Palo Seco/Erin/McKenzie, 1926	12,718	493	1,581			...
	• Other		196	923			...
PREMIER CONSOLIDATED OILFIELDS LTD. (P.C.O.L.) (e)	• All fields		103	503			...
	Total Trinidad and Tobago		3,203	13,546	150,791	2,554,851,000	
TUNISIA	ELF-ETAP • Ashraf	10,500	15	20	25,682	202,419,579	29.8
	ELF-SEREPT • Douleb/Semmama, 1966	3,937	12	15	539	18,351,768	40.0
	• Tamesmda, 1967	3,937	3	3	160	2,209,426	36.9
	ETAP-AGIP-FINA (SOOEPS) • Defech, 1980	7,500	1	1	17	265,730	42.8
	• Larich, 1979	7,550	1	2	107	353,070	41.0
	• Makrouga, 1980	6,230	4	4	5,690	9,644,920	45.6
	AGIP-TUNISIA (SITER) • Couch ee Saids, 1971	12,600	1	1	250	2,892,240	43.2
	• El Borma, 1964	8,250-8,900	95	130	50,950	559,242,360	...
	BRITISH GAS • El Ain, 1980	8,500	1	1	1,684	1,243,000	41.0
	MARATHON • Ezzaoua, 1965	6,800	5	5	2,000	715,000	40.0
	SHELL (e) • Tazerka, 1979		...	...	2,886		30.0
	CFPT (e) • Sidi El Itayem, 1971	7,500-7,800	21	23	2,507	154,925,365	44.0
	Total Tunisia		199	205	92,472	963,263,258	
TURKEY	ALADON MIDDLE EAST LTD. • Kahla, 1958	3,500	11	25	142	4,182,072	11.0
	• Yasince, 1974	6,400	2	4	10	13,752	31.0
	• Zeynel, 1990	4,700	1	1	11	3,909	23.0
	MOBIL • Bulgurdag, 1961	4,500	2	2	37	2,509,803	37.2
	• Semo, 1964	5,800	22	22	3,995	89,541,465	34.2
	SHELL • Barbes, 1972		18	22	1,280	17,280,000	37.2
	• Baysu, 1985		6	7	904	1,490,000	34.5
	• Beklas, 1985		1	1	274	540,000	34.7
	• Beykan, 1964		38	48	2,356	61,520,000	33.2
	• Kastel, 1990		...	...	356	130,000	34.7
	• Katin, 1971		3	8	82	3,760,000	29.7
	• Kay West (deep), 1970		...	...	1,507	550,000	34.1
	• Kayakoy West (OF), 1964		19	29	767	31,720,000	34.1
	• Kayakoy, 1980		14	27	1,288	20,670,000	38.2
	• Kopru, 1990		...	...	27	10,000	35.2
	• Kurkan, 1963		29	35	1,315	50,100,000	31.4
	• Kurkan S, 1985		5	10	1,233	7,880,000	34.5
	• Makiupe, 1970		14	15	575	7,400,000	32.7
	• Northern Trend, 1972		...	...	82	350,000	30.0
	• Piyanko, 1968		1	3	82	1,550,000	35.3
	• Sahaban, 1965		7	13	712	13,700,000	34.5
	• Sahaban SE, 1983		2	2	110	510,000	34.5
	• Sincan, 1979		8	9	877	3,640,000	31.4
	• Yaltir E, 1973		9	11	274	5,550,000	30.9
	• Yenikoy E, 1974		2	2	356	4,700,000	31.3
	• Yesildere, 1985		3	3	775	880,000	34.5

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		1980 average b/d	Cumulative to Dec. 31, 1980 bbl	*API gravity
		Producing	Total			
TPAO						
Adiyaman, 1971	5,800	10	10	685	8,671,031	27.6
Akpinar, 1984	10,500	—	—	—	157,937	31.6
Acik, 1983	6,500	1	1	4	96,864	32.0
B. Firat, 1986	8,150	11	11	134	1,803,829	34.8
B. Kozluca, 1985	5,000	23	23	727	1,828,855	12.0
B. Saimo, 1981	5,500	3	3	179	804,469	34.0
Bati Raman, 1981	4,200	149	149	9,026	41,187,581	13.3
Beekdi, 1989	6,234	3	3	1,118	408,041	25.6
Beycayir, 1976	7,700	1	1	31	219,201	26.4
Bolukyayla, 1977	10,300	—	—	—	187,863	35.0
Camurlu, 1976	5,800	14	14	301	1,296,898	12.2
Celik, 1984	10,500	11	11	616	4,046,269	35.2
Cemberlitas, 1983	8,500	17	17	1,865	8,815,619	30.5
Cendere (J.V.), 1989	8,856	3	3	1,453	530,204	29.4
Cukurtas, 1985	10,000	—	—	—	219,021	36.0
Devceciak, 1973	4,800	2	2	77	299,035	37.0
G. Adiyaman, 1977	5,000	—	—	—	115,836	20.4
G. Dincer, 1981	5,350	14	14	846	5,170,219	16.7
G. Karakus, 1989	7,900	3	3	1,049	422,656	26.5
G. Kayakoy, 1976	8,800	1	1	160	2,405,770	30.4
G. Sahaban, 1978	5,450	7	7	455	3,400,791	33.2
G. Saricak, 1973	5,250	10	10	517	4,573,485	31.5
Gazran, 1956	4,700	16	16	1,192	33,820,729	26.2
Germik, 1968	6,500	9	9	223	3,569,634	18.3
Ikiztepe, 1976	4,900	—	—	—	88,051	11.3
K. Karakus, 1989	8,498	5	5	5,272	1,962,077	29.0
K. Osmancik, 1971	3,800	3	3	229	2,259,094	37.6
Karsali (J.V.), 1989	9,941	1	1	194	162,051	24.6
Karakus, 1988	6,850	15	15	17,736	9,672,352	30.0
Kartaltepe, 1982	6,500	3	3	293	1,124,863	32.0
Kastel (J.V.), 1989	7,625	2	2	727	265,386	34.7
Kurtalan, 1981	5,750	1	1	20	258,455	31.9
Kuzey Adiyaman, 1977	9,500	—	—	—	59,375	32.0
Magrip, 1981	5,700	9	9	619	15,336,442	18.4
Mehmeddere, 1982	6,700	—	—	—	157,439	31.0
Oyuktas, 1972	7,600	—	—	—	592,005	31.0
Raman, 1940	4,500	77	77	4,042	53,538,328	18.7
S. Sinan, 1987	3,900	4	4	80	148,048	13.0
Saricak, 1973	5,250	4	4	204	2,811,755	31.5
Sezgin, 1970	5,600	—	—	—	87,559	17.0
Silivanku, 1982	8,200	11	11	728	8,473,463	23.0
Sivritape, 1977	8,200	—	—	—	591,789	33.4
Yanarsu, 1990	4,725	1	1	26	9,520	14.7
Yenikoy, 1973	6,400	23	23	2,006	10,500,534	31.4
Total Turkey		684	786	72,241	542,121,224	

UNITED KINGDOM

AMOCO	• Arbroath, 1969	8,100	7	10	22,576	8,240,157	37.0
	• Indefatigable ^(C) , 1966	8,500	33	39	463	4,675,302	46.0
	• Leman (ELU) ^(C) , 1966	6,500	84	91	302	3,476,642	51.0
	• Montrose, 1969	8,100	14	20	1,392	80,121,321	37.0
	• NW Hutton, 1975	11,200	30	39	17,694	105,342,717	36.0
BP	• Beatrice (A & B), 1976	6,750	27	39	24,808	—	36.4
	• Buchan, 1974	8,700	9	9	17,553	—	33.0
	• Clyde, 1978	12,400	10	30	38,257	—	36.1
	• Cyrus, 1979	8,285	2	4	5,526	—	35.5
	• Davros, 1972	9,000	3	3	4,495	—	36.2
	• Don, 1976	11,200	3	4	6,238	—	42.0
	• East Midlands, 1939	3,500	65	132	24,204	—	36.0
	• Forties and Echo, 1970	7,000	79	103	193,024	—	37.0
	• Kimmendge, 1959	1,705	1	1	37,004	3,126,892,477	40.0
	• Magnus, 1974	9,500	11	11	135,427	—	39.0
	• Hettieham, 1983	8,650	1	2	7,782	—	35.0
	• Scampton, 1985	5,360	1	3	7,305	—	—
	• Stainton, 1984	5,200	1	3	443	—	—
	• Thistle, 1973	9,000	33	52	29,731	—	38.0
	• Wytch Farm, 1981	5,000	—	—	40,262	—	36.0
	• Wytch Farm Bridport Sand, 1974	3,031	10	16	—	—	37.0
	• Wytch Farm Sherwood Sandstone, 1978	5,198	5	5	—	—	37.9
CHEVRON	• Ninian, 1974	10,000	74	105	116,903	900,858,024	35.6
CONOCO	• Hutton, 1973	10,000	15	27	28,632	127,881,199	33.0
	• Murchison ⁺ , 1975	9,900	21	34	28,509	223,063,893	38.0
HAMILTON BROS. OIL & GAS LTD.	• Argyll, 1971	9,000-9,400	7	7	4,920	70,030,000	38.0
	• Crawford, 1975	8,900-8,500	8	8	4,940	3,930,000	30.0
	• Duncan, 1980	9,600-10,000	2	2	1,060	18,370,000	36.0
	• Innes, 1983	12,300-12,800	2	2	850	5,750,000	45.0
MARATHON	• Central Brae, 1978	14,100-15,000	3	5	15,500	7,000,000	33.0
	• North Brae ^(M) , 1975	11,800-12,475	11	16	80,400	66,000,000	45.0
	• South Brae, 1975	12,700-13,437	12	29	33,400	226,000,000	35.0

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
		Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl	
MOBIL						
• Beryl, 1972	9,900-11,500	41	67	94,700	461,983,427	37.0
• Linnite, 1966	11,500-12,065	1	2	1,100	577,286	37.8
• Ness, 1966	9,900-10,112	4	6	10,400	16,977,501	37.0
OCCIDENTAL						
• Claymore, 1974	8,100	17	29	39,525	339,020,933	30.1
• Piper, 1973	8,100	...	...	...	834,416,000	37.0
• Scape, 1981	8,100	5	5	24,859	30,359,688	32.0
SHELL						
• Auk, 1971	...	9	11	8,219	85,700,000	38.0
• Brent, 1971	...	53	130	73,973	1,304,400,000	40.0
• Cormorant, 1972	...	17	37	86,027	355,800,000	38.0
• Dunlin, 1973	...	28	40	22,669	325,528,000	38.0
• Eider, 1976	...	...	...	40,548	30,000,000	34.0
• Fulmar, 1975	...	13	28	149,247	446,620,000	40.0
• Kittiwake, 1981	...	...	...	5,205	1,800,000	30.0
• Tern, 1975	...	...	...	34,247	18,900,000	34.0
PHILLIPS						
• Maureen, 1973	8,000-8,700	6	12	32,035	186,560,640	35.9
TEXACO NORTH SEA						
• Highlander, 1976	8,759-9,372	5	7	18,000	47,423,000	34.0
• Petronella, 1975	8,110	1	1	12,300	15,232,000	40.2
• Tartan, 1974	10,217-12,614	8	20	16,200	78,108,000	38.0
TOTAL OIL MARINE						
• Alwyn North, 1975	10,170-11,155	10	30	89,400	90,210,500	39.0
UNOCAL						
• Heather, 1973	10,800	24	40	11,040	88,209,901	34.3
ELF UK						
• Crosby-Warren, 1986	...	...	...	129	306,000	...
STATOIL^(a)						
• Statfjord, 1975	9,300	59	93	106,616	315,020,800	39.0
Total United Kingdom		880	1,406	1,807,808	10,030,701,408	

^(a)U.K. share (77.6%) of total production.

UNITED STATES*

Alabama, 1944	...	902	...	50,789	321,538,000	...
Alaska, 1905	...	1,382	...	1,773,452	8,122,310,000	...
Arizona, 1958	...	24	...	334	19,728,000	...
Arkansas, 1921	...	7,565	...	28,458	1,644,387,000	...
California, 1861	...	43,977	...	961,370	22,701,900,000	...
Colorado, 1887	...	6,479	...	83,436	1,584,454,000	...
Florida, 1943	...	92	...	15,545	803,674,000	...
Illinois, 1869	...	32,158	...	54,668	3,329,854,000	...
Indiana, 1889	...	7,525	...	8,219	515,000,000	...
Kansas, 1889	...	45,220	...	151,855	5,553,427,000	...
Kentucky, 1860	...	22,800	...	14,825	707,411,000	...
Louisiana, 1902	...	26,759	...	1,076,506	24,653,925,000	...
Michigan, 1900	...	5,064	...	53,904	1,088,675,000	...
Mississippi, 1869	...	2,879	...	74,063	2,221,033,000	...
Missouri, 1888	...	831	...	400	4,159,000	...
Montana, 1914	...	3,824	...	54,274	1,310,810,000	...
Nebraska, 1939	...	1,614	...	16,137	453,890,000	...
Nevada, 1954	...	45	...	10,982	30,596,000	...
New Mexico, 1911	...	18,167	...	184,238	5,515,247,000	...
New York, 1865	...	4,197	...	1,140	80,146,000	...
North Dakota, 1951	...	3,494	...	100,592	1,018,716,000	...
Ohio, 1860	...	30,142	...	27,419	982,008,000	...
Oklahoma, 1891	...	89,008	...	307,800	13,272,274,000	...
Pennsylvania, 1859	...	24,778	...	7,241	1,325,643,000	...
South Dakota, 1954	...	153	...	4,515	21,537,000	...
Tennessee, 1860	...	725	...	1,382	14,547,000	...
Texas, 1889	...	187,869	...	1,925,886	61,028,941,000	...
Utah, 1907	...	2,103	...	75,627	918,604,000	...
Virginia, 1943	...	23	...	41	570,000	...
West Virginia, 1880	...	15,945	...	5,871	568,143,000	...
Wyoming, 1894	...	11,468	...	294,534	5,861,855,000	...
Total United States		897,326		7,388,303	188,283,982,000	

*Discovery date indicates first year of production in state. There are 32,975 oil fields in the U.S.

VENEZUELA

PDVSA/ZULIA						
Altavilla	...	8	16	2,642	4,140,418	32.2
Sachequero, 1930	10,720	1,302	1,507	245,929	6,631,194,318	22.9
Barus, 1925	...	11	19	1,091	31,975,134	20.8
Boscan, 1946	9,708	423	695	28,851	803,178,000	10.2
Cabimas, 1917	2,200	151	832	46,880	757,784,958	22.4
Centro, 1959	9,800-11,000	27	62	148,065	991,844,863	33.6
Ceuta	16,380	126	284	63,957	506,636,876	30.2
Cruces-Manuelitas, 1915	3,000-6,000	41	193	1,638	177,887,841	30.2
La Concepcion, 1953	3,148-6,000	50	189	7,893	139,718,456	30.1
La Paz, 1925	4,288-6,000	52	195	9,252	865,729,056	30.1
Lago, 1959	11,450	31	104	17,024	274,861,452	30.5
Lagunitas, 1929	3,000	1,737	2,235	361,083	11,086,650,262	22.0
Lama, 1957	8,320	201	376	135,629	7,679,286,645	32.2
Lamar, 1959	13,000	75	161	81,396	1,192,397,988	33.5
Mera, 1945	5,240	46	123	5,804	417,706,447	26.8
Mene Grande, 1914	4,130	184	779	340	637,756,243	19.9
Motatan, 1952	...	24	37	46,814	118,241,082	22.0
Sibucana, 1948	13,460	1	3	461	43,586,251	...
Sur del Lago	17,830	...	...	15,000	23,385,201	33.6
Tie Juana, 1929	3,000	1,888	2,194	141,300	4,110,081,045	17.9
Urdaneta, 1970	10,000	2	3	42,389	166,221,172	22.0
West-Tara, 1942	4,250-5,500	14	46	2,128	74,780,393	30.2

PRODUCTION

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
			Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl	
PDVSA/ANZOATEGUI	Adjuntas, 1957	5,000	...	...	...	8,714,849	13.9
	Arecuna	1,300	89	121	4,955	12,806,234	11.0
	Bare	1,110	198	281	30,586	37,140,022	10.2
	Boca, 1971	9,500	7	63	697	9,289,018	32.2
	Caico Seco, 1946	6,500-7,300	1	16	243	35,541,370	31.8
	Chimire, 1948	7,000-7,200	17	89	2,550	301,080,007	31.1
	Dacion, 1957	6,700	79	155	6,179	232,212,117	23.0
	El Roble, 1939	3,500-11,500	26	70	2,081	43,867,479	49.3
	El Toco	2,300	30	47	1,437	16,046,619	23.7
	Elias, 1954	5,000-6,470	40	140	6,166	...	...
	Guara, 1946	5,000-10,000	97	276	11,262	260,716,726	27.0
	Guario, 1940	3,400	17	63	1,598	54,913,244	43.6
	Guico, 1944	4,500-7,000	14	67	1,450	88,308,067	25.4
	Inca, 1948	7,250	1	10	4,328	62,307,133	28.2
	Isala, 1954	...	23	74	...	...	40.5
	La Ceiba, 1946	9,450	20	39	2,223	50,547,306	41.9
	La Ceiba, 1963	9,678	16	57	1,816	83,981,042	42.0
	Leona, 1938	2,200-12,800	12	77	1,089	52,278,878	26.7
	Meta, 1954	8,970-10,516	51	410	7,166	474,216,931	35.9
	Merrey, 1937	5,400-5,700	20	47	1,061	35,459,301	12.5
	Nipa, 1945	6,000-8,500	18	133	2,288	201,028,306	29.6
	Oficina, 1937	5,900	39	195	717	383,319,088	26.1
	Oscurote-Norte, 1952	9,513	12	83	1,473	113,562,316	24.2
	Pato Este, 1988	...	1	1	69	163,636	41.9
	San Joaquin, 1939	6,550	74	135	4,766	99,299,657	51.3
	Soto, 1950	9,500	14	103	768	94,229,440	...
	Sta. Ana, 1936	8,500	38	116	4,641	125,644,217	45.6
	Sta. Rosa, 1941	8,500	152	250	8,453	391,896,543	45.7
	Yopales, 1937	4,600	102	245	9,328	136,654,306	22.6
	Zanjas, 1958	13,270	9	20	1,688	41,350,164	38.1
	Zapalos, 1955	11,500	14	71	3,022	182,354,036	32.4
	Zorro, 1953	11,100	10	34	1,261	75,106,585	29.3
	Zulus, 1957	12,710	8	28	1,183	25,413,648	41.2
	Zurmo, 1954	9,200	7	39	953	70,983,494	25.3
PDVSA/MONAGAS	Acema, 1980	...	58	136	11,618	81,638,039	26.4
	Acema-Casma	4,023	13	24	11,256	89,426,830	24.3
	Aguasay, 1955	8,100-13,400	10	60	2,658	100,281,853	41.3
	Aguasay Norte-Sur, 1955	4,649	8	24	1,002	23,765,381	42.4
	Caneto, 1984	4,881	7	8	3,791	7,682,047	41.7
	Canto, 1988	...	11	12	53,626	93,390,836	31.4
	Cerro Negro	1,200	18	143	5,233	26,650,838	9.0
	Furriel, 1988	...	4	4	132,946	129,833,355	26.3
	Jobo, 1956	3,800-4,000	137	472	21,185	290,626,707	10.3
	Juapin, 1936	4,253	3	483	15,685	203,577,118	26.5
	Mannara, 1954	...	...	14	...	...	16.7
	Meta Acema, 1951	...	...	...	4,891	89,426,830	27.0
	Morichal, 1958	3,312	46	262	3,569	173,632,723	9.2
	Musipin, 1985	16,500	13	14	49,180	116,806,387	32.0
	Onado, 1971	4,791	5	26	961	80,705,619	28.0
	Ortupano, 1950	7,657	16	69	2,877	38,831,574	18.4
	Ortupano Norte-Sur, 1954	...	26	171	5,161	521,968,030	24.1
	Orocusi, 1953	2,964	10	82	1,052	31,228,156	25.1
	Pilon, 1937	...	49	148	8,152	159,565,062	11.6
	Pirital, 1958	450-1,100	93	93	75,439	27,536,135	...
	Quinquere, 1928	7,000-7,200	...	...	1,075	781,884,081	27.7
	Sta. Barbara, 1941	5,020-6,500	2	375	29,542	164,751,780	31.4
	Tacot, 1953	1,820-3,670	...	140	...	48,743,457	...
	Tembledor, 1936	3,500-4,500	11	139	1,269	110,095,951	18.7
PDVSA/BARINAS	Guafita, 1984	8,500	28	28	45,980	86,703,909	29.1
	Helo, 1965	9,550	11	18	2,444	45,416,902	22.7
	La Victoria, 1987	...	12	12	25,845	15,466,832	34.5
	Maporal, 1957	10,950	11	16	2,392	18,014,999	25.7
	Paez, 1963	...	49	67	7,880	89,795,021	19.9
	Silven, 1949	10,860	17	22	2,286	51,672,015	26.8
	Silvestre, 1948	8,860	20	57	3,030	139,495,891	22.1
	Sinco, 1963	8,500-9,100	41	87	6,404	264,353,628	21.5
	Other	...	4	5	247	3,518,121	...
	Barzo, 1959	...	3	6	184	2,455,211	24.0
PDVSA/GUAYARICO	Budare, 1958	4,523	26	50	8,503	75,378,639	31.1
	Jobal, 1980	...	8	14	129	2,247,325	33.6
	Las Mercedes, 1942	4,500	...	285	...	91,850,707	...
	Ruiz, 1949	4,500	...	67	...	33,189,614	...
	Saben, 1947	...	9	98	181	22,306,002	43.9
PDVSA/AMACURO	Tucupita, 1945	...	...	48	...	67,074,189	...
PDVSA/FALCON	All fields, 1930	...	...	...	...	108,212,457	27.4
Total Venezuela			8,436	17,368	2,884,839	64,381,464,376	
YEMEN	HUNT OIL						
	Al-Shura, 1989	7,800	3	4	2,000	756,000	40.0
	Alil, 1954	5,750	54	96	154,400	178,445,000	40.0
	Al-Widash, 1989	7,500	1	1	...	18,000	40.0

PRODUCTION

WORLDWIDE PRODUCTION

Name of field, discovery date	Depth, ft	No. of wells		Production		API gravity
		Producing	Total	1980 average b/d	Cumulative to Dec. 31, 1980 bbl	
Ass'ad Al-Kamil, 1967	6,100	17	31	10,100	3,685,000	40.0
Azal, 1967	6,850	10	16	20,800	21,513,000	40.0
Jabal Nuqum, 1968	3,780	1	1	1,100	661,000	44.0
Saif Ben The-Yazen, 1968	7,600	1	2	1,100	662,000	40.0
Total Yemen		87	161	188,300	364,196,000	

YUGOSLAVIA

INA-
NAFTAPLJIN

NAFTA-GAS^(a)

Beničanci, 1966	6,752-9,938	25	27	3,978	105,524,222	30.2
Bilogora, 1966	3,346-5,052	37	50	680	8,607,666	40.8
Bizovac, 1969	5,483-5,499	2	7	223	113,644	33.8
Bokšić-Kokotšević, 1975	7,218-10,171	8	9	61	257,280	31.0
Bunjani, 1951	1,800-3,550	21	27	91	2,547,471	30.2
Cmac, 1977	6,814-6,061	2	2	63	175,702	34.6
Deletovci, 1982	3,143-3,422	46	47	3,512	7,462,429	28.9
Dugo Selo, 1953	3,445-4,183	15	16	422	9,936,794	31.1
Ferdinandovac, 1959	5,625-5,915	5	6	104	1,325,177	36.0
Reča, 1982	3,445-3,855	10	15	265	504,163	31.1
Ivančić Grad, 1959	5,282-5,709	46	47	3,415	45,396,388	33.4
Jagrjedovac, 1981	2,864-3,570	25	30	414	6,550,917	33.0
Jamerice, 1965	3,281-5,512	88	103	2,564	16,164,824	37.8
Jaževci, 1963	6,234-7,362	8	11	82	869,573	36.7
Kalinovac ⁽¹⁾ , 1978	11,841-14,682	14	19	6,982	7,800,225	51.5
Kloštar, 1952	2,397-4,583	74	82	968	40,777,483	36.3
Kozarice, 1972	3,281-3,609	19	20	401	1,779,235	23.6
Križ, 1948	1,600-2,250	30	50	89	6,527,336	17.4
Kučani-Kapelna, 1973	6,562-7,218	14	17	1,033	1,755,354	25.2
Lacići, 1979	7,605-8,012	7	9	2,900	5,073,212	36.6
Lepavina, 1969	1,780-2,200	8	8	224	920,587	22.8
Lešani, 1989	4,584-4,817	5	5	135	88,875	35.0
Lipovljani, 1980	3,937-5,708	64	90	2,055	22,897,611	36.7
Lupoglav, 1971	3,890-5,600	5	5	100	176,782	33.4
Mihovljani, 1973	5,150-5,760	4	4	84	89,797	32.5
Molva ⁽¹⁾ , 1974	10,263-11,345	17	20	958	2,528,703	57.2
Mramor Brdo, 1949	2,625-4,101	4	4	38	4,553,612	31.1
Obod, 1967	6,378-7,550	1	8	165	2,284,463	32.5
Okoli, 1962	7,362-8,368	4	4	375	675,904	36.5
Okoli ⁽¹⁾ , 1962	7,218-7,874	10	15	506	1,014,940	30.6
Privlaka, 1983	2,933-3,041	13	17	1,124	1,793,385	25.9
Sandrovec, 1962	2,250-3,700	98	158	3,972	39,416,887	37.8
Stari Gradac ⁽¹⁾ , 1980	11,720-13,630	3	7	752	689,332	51.4
Števkovica, 1978	7,710-9,843	17	25	791	4,165,103	31.9
Struzec, 1956	2,362-3,773	60	81	5,385	103,267,756	36.8
Vazisće, 1965	6,135-6,562	5	5	18	54,667	31.6
Žutica, 1963	5,742-6,923	167	173	6,941	66,564,037	33.8
Other ⁽¹⁾	5,258-11,800	17	21	231	654,136	67.9
Total Yugoslavia		1,848	2,398	63,916	739,485,142	

ZAIRE

ZAIREP (FIMA)

ZAIRE

CHEVRON	• GCO, 1970	7,000-9,000	5	13	174	8,450,377	36.7
	• Libwa, 1981	5,500	3	3	1,553	565,157	33.0
	• Lukani, 1983	12,400	6	9	1,383	7,805,246	33.2
	• Mibele, 1973	5,000-6,000	5	5	9,176	82,349,447	30.0
	• Moloba, 1976	11,098	9	9	7,383	8,215,914	31.5
	• Mesambe, 1979	6,150	1	2	156	705,966	29.7
	• Moko, 1972	12,310	1	1	424	154,253	32.0
ZAIREP (FINA)	East Mibele, 1978	6,000	—	1	—	387,000	34.0
	Kikuku, 1983	3,400	1	1	14	56,088	31.0
	Kinkasi, 1972	3,700	41	42	2,178	8,975,168	31.0
	Liwenda, 1972	3,900	30	36	1,553	4,586,861	31.0
	Makolekasa, 1983	3,600	8	8	368	10,490,938	31.0
	Muanda, 1972	3,600	6	7	348	948,485	31.0
	Niamfumu, 1977	8,300	—	1	—	5,000	34.0
	Tshenda, 1978	6,000	5	8	4,387	9,312,306	34.0
	Total Zaire		121	148	29,118	181,216,838	

U.S. fields with oil reserves exceeding 100 million bbl

State	Disc. Field year	1991 prod.	Cum prod. 1-1-92 1,000 bbl	Est. rem. reserves	Est. No. prod. wells
ALABAMA					
	Citronelle, 1955	1,520	152,762	8,550	440
ALASKA					
	•Endicott, 1978	41,153	161,226	214,107	56
	•Granite Point, 1965	2,075	115,345	13,392	27
	Kuparuk River, 1969	112,223	837,491	\$1,063,748	341
	Lisburne, 1967	13,558	77,684	132,615	71
	•McArthur River, 1965	7,200	547,298	28,360	81
	•Middle Ground Shoal, 1962	2,648	164,303	2,173	44
	Prudhoe Bay, 1968	*473,165	†7,551,472	‡4,448,528	855
	Swanson River, 1957	1,966	215,158	4,182	29
*Includes 42.17 million bbl of condensate. †Includes 243.34 million bbl of condensate. ‡Estimate of ultimate recovery increased in 1991.					
ARKANSAS					
	Magnolia, 1938	500	163,190	5,228	56
	Snackover, 1922	2,007	563,913	3,701	1,573
CALIFORNIA					
	San Joaquin Valley				
	Belridge South, 1911	55,899	847,388	264,981	5,176
	Buena Vista, 1909	1,525	651,971	22,205	808
	Coalinga, 1890	12,472	788,046	117,625	2,109
	Coalinga Nose, 1938	700	501,363	6,751	74
	Coles Levee North, 1938	337	161,627	3,046	69
	Cuyama South, 1949	383	219,424	5,705	94
	Cymric, 1909	10,448	228,599	66,361	1,039
	Edison, 1928	1,044	137,573	16,459	656
	Elk Hills, 1911	26,358	985,340	516,752	1,045
	Fruitvale, 1928	525	117,036	12,226	231
	Greeley, 1936	212	113,176	1,234	23
	Kern Front, 1912	2,721	179,438	48,858	845
	Kern River, 1899	44,874	1,339,460	606,192	7,260
	Kettleman North Dome, 1928	169	457,167	779	45
	Lost Hills, 1910	8,024	198,812	117,618	1,916
	McKittrick, 1896	1,542	272,415	85,326	730
	Midway-Sunset, 1894	61,454	2,056,855	695,502	10,720
	Mount Poso, 1926	5,110	280,182	62,348	572
	Rio Bravo, 1937	51	116,271	456	8
	Yowlumne, 1974	3,911	96,023	13,288	64
	Coastal Area				
	•Carpinteria, 1966	1,569	93,339	24,388	110
	Cat Canyon E. & W., 1908	1,222	292,943	27,981	379
	•Dos Cuadras, 1969	3,263	223,655	43,289	94
	•Elwood, 1928	163	106,369	1,619	7
	•Hondo, 1969	8,222	115,220	85,381	21
	Orcutt, 1901	816	168,342	10,697	139
	•Point Arguello, 1981*	4,620	4,620	1	16
	•Point Piedrales, 1982†	4,644	28,807	43,676	11
	•Rincon, 1927	931	151,765	13,164	177
	San Ardo, 1947	3,843	419,881	111,373	480
	Santa Maria Valley, 1934	910	201,545	17,199	124
	South Mountain, 1916	720	148,116	9,903	359
	Ventura, 1919	6,365	914,434	86,825	525
	Los Angeles basin				
	•Beta, 1976	4,589	55,190	75,767	65
	Beverly Hills, 1900	1,676	128,005	36,967	89
	Brea-Olinda, 1880	1,717	389,749	48,932	724
	Coyote East, 1909	556	110,322	11,553	83
	Coyote West, 1909	464	251,748	5,702	99
	Dominguez, 1923	577	270,995	5,718	103
	•Huntington Beach, 1920	3,869	1,079,189	59,223	464
	Inglewood, 1924	2,186	352,720	46,882	253
	•Long Beach, 1921	2,000	916,172	10,801	366
	Montebello, 1917	503	194,023	8,601	114
	Richfield, 1919	1,054	192,791	23,786	192
	Santa Fe Springs, 1919	868	615,928	17,511	136
	•Seal Beach, 1924	703	205,344	11,892	161
	•Torrance, 1922	1,258	216,115	31,815	277
	•Wilmington, 1932	24,902	2,369,886	417,976	1,658
*Production started up in June 1991. †Reserves estimated at 300-500 million bbl.					
‡Revised to reflect only developed portion of field. Original estimate of total field reserves is 350 million bbl.					
COLORADO					
	Rangely, 1933	12,611	776,846	127,154	507
FLORIDA					
	Jay, 1970	2,010	371,032	25,524	55
ILLINOIS					
	Clay City, 1938	2,055	400,364	1,704	762
	Dale Consolidated, 1940	149	104,895	1,296	101
	Lawrence, 1906	2,490	402,340	4,547	288
State	Disc. Field year	1991 prod.	Cum prod. 1-1-92 1,000 bbl	Est. rem. reserves	Est. No. prod. wells
LOUISIANA					
	Offshore				
	•Bay Marchand Block 2, 1949	10,019	625,999	30,273	213
	•Breton Sound Block 20, 1953	2,555	97,202	22,811	89
	•Eugene Island Block 175, 1956	1,302	72,650	35,313	26
	•Eugene Island Block 276, 1964	1,260	75,726	26,004	38
	•Eugene Island Block 330, 1971	5,250	288,543	36,455	105
	•Grand Isle Block 16, 1948	2,214	272,441	76,933	45
	•Grand Isle Block 43, 1956	3,191	284,060	73,884	81
	•Grand Isle Block 47, 1955	2,005	84,901	31,540	41
	•Main Pass Block 35, 1951	425	96,271	4,002	45
	•Main Pass Block 41, 1957	1,901	244,985	16,253	68
	•Main Pass Block 69, 1948	2,214	246,331	14,116	97
	•Main Pass Block 306, 1969	901	205,622	7,218	59
	•Mississippi Canyon Block 194 (Cognac), 1980	8,155	128,525	—	32
	•Ship Shoal Block 207, 1967	740	90,204	10,612	22
	•Ship Shoal Block 208, 1962	2,535	168,975	18,787	40
	•South Marsh Island Block 128, 1974	3,281	100,172	17,670	41
	•South Marsh Island Block 130, 1975	5,367	145,649	30,910	82
	•South Pass Block 24, 1950	1,615	260,351	15,965	166
	•South Pass Block 27, 1954	1,755	135,151	11,645	178
	•South Pass Block 61, 1968	6,325	171,441	28,966	156
	•South Pass Block 62, 1965	2,150	113,255	24,703	68
	•South Pass Block 65, 1965	2,376	109,231	18,950	55
	•South Pass Block 89, 1969	645	98,864	4,211	149
	•South Timberlaver Block 21, 1939	1,950	222,287	13,805	44
	•South Timberlaver Block 135, 1956	714	142,551	8,156	25
	•West Delta Block 30, 1949	5,315	462,749	30,706	131
	•West Delta Block 73, 1962	6,200	201,616	73,375	76
	•West Delta Block 79, 1966	2,890	138,175	22,760	62
	Onshore South				
	Avery Island, 1942	910	94,827	4,277	16
	Bay de Chene, 1941	241	97,335	5,614	20
	Bay St. Elaine, 1926	232	165,853	2,476	16
	Bayou Sale, 1941	310	162,827	1,959	16
	Black Bay West, 1953	1,650	150,535	8,918	67
	Cattou Island, 1930	1,694	608,334	7,940	121
	Cote Blanche Bay West, 1940	775	184,471	43,497	93
	Cote Blanche Island, 1948	589	184,285	2,281	90
	Delta Farms, 1944	675	117,165	5,205	33
	Garden Island Bay, 1934	714	224,001	6,227	78
	Golden Meadow, 1936	480	137,138	2,591	131
	Grand Bay, 1938	625	172,207	4,614	70
	Hackberry, East, 1927	489	110,586	6,104	51
	Hackberry, West, 1928	895	145,437	3,872	107
	Iberia, 1917	555	96,862	3,119	49
	Iowa, 1931	80	99,619	381	15
	Jennings, 1901	212	117,112	1,396	176
	Lafitte, 1935	1,009	258,847	6,007	99
	Lake Barre, 1929	612	206,773	17,311	26
	Lake Peto, 1929	301	118,228	16,187	16
	Lake Washington, 1931	1,972	249,257	9,509	80
	Leeville, 1931	480	143,236	5,631	37
	Paradis, 1939	475	128,347	6,903	27
	Quarantine Bay, 1937	695	174,928	13,500	29
	Romere Pass, 1950	514	96,226	3,015	32
	Timbalier Bay, 1938 onshore	525	298,244	22,097	64
	Venice, 1937	555	183,938	5,532	40
	Vinton, 1910	295	161,925	1,576	96
	Weeks Island, 1945	895	228,916	18,379	16
	West Bay, 1940	709	230,985	13,616	58
	White Castle, 1929	1,159	91,354	8,772	48
	North				
	Caddo-Pine Island, 1905	2,356	369,514	11,995	11,352
	Delhi, 1944	330	212,999	3,359	54
	Haynesville, 1921	1,510	171,626	9,114	131
	Horner, 1919	347	99,520	1,993	173
	Rodessa, 1935	330	107,117	2,129	78

U.S. fields with oil reserves exceeding 100 million bbl (continued)

Disc. State Field year	1991 prod.	Cum prod. 1-1-92 1,000 bbl	Est. rem. reserves	Est. No. prod. wells	Disc. State Field year	1991 prod.	Cum prod. 1-1-92 1,000 bbl	Est. rem. reserves	Est. No. prod. wells
MICHIGAN					Hawkins, 1940	5,411	840,127	23,889	408
Albion-Pulaski-Scipio, 1957	29	>132,202	9,928	330	Neches, 1953	865	106,728	3,288	163
MISSISSIPPI					Quitman, 1948	1,060	124,868	4,918	157
Baxterville, 1944	1,810	245,284	12,595	185	Talco, 1931	2,032	278,402	15,519	484
Heidelberg, 1944	2,359	182,079	11,722	209	Dist. 7B—West Central				
Tinsley, 1939	611	221,629	3,874	98	Stephens County Reg., 1916	4,915	149,340	29,215	1,051
MONTANA					Dist. 7C—West Central				
Beil Creek, 1967	455	131,153	2,553	69	Big Lake, 1923	485	131,410	2,030	88
Cabin Creek, 1953	1,162	93,935	7,592	92	McCahey, 1925	295	125,117	1,496	589
Curt Bank, 1926	787	164,763	4,804	536	Pogopus, 1949	817	137,631	4,319	178
Eik Basin, 1915	562	90,832	3,253	45	Dist. 8—West				
Pine, 1951	1,160	108,821	6,218	100	Andector, 1946	487	183,559	4,829	42
NEW MEXICO					Block 31, 1945	2,185	228,002	14,548	214
Denton, 1949	770	141,140	4,223	77	Cowden, N., 1930	13,319	528,650	64,301	1,375
Empire-Abo, 1957	1,005	223,782	6,218	240	Cowden, S.,				
Eunice-Monument, 1929	2,133	132,736	10,675	494	Foster, Johnson 1930	7,794	525,892	36,717	1,569
Hobbs, 1928	5,327	316,109	27,823	340	Dollarhide, 1945	2,504	201,290	13,992	238
Maljamar, 1926	1,503	149,911	9,952	518	Dune, 1938	2,200	189,867	11,837	694
Vacuun, 1929	8,408	460,314	42,611	696	Fuhrman-Mascho, 1930	1,409	110,015	8,009	753
NORTH DAKOTA					Fullerton, 1942	7,413	370,669	45,833	908
Beaver Lodge, 1951	1,498	116,122	12,034	62	Goldsmith, 1934	5,278	772,793	31,616	1,393
OKLAHOMA					Hendrick, 1926	475	253,764	2,222	185
Bowlegs, 1927	160	152,987	1,820	114	Howard-Glasscock, 1925	5,697	420,786	27,292	2,082
Burbank, 1920	852	539,392	5,731	933	Iatan, E., 1926	2,714	151,408	14,018	1,257
Cement, 1917	1,201	134,792	7,802	843	Jordan, 1937	725	131,393	4,110	222
Earlsboro, 1926	197	202,531	1,693	78	Kermil, 1928	365	114,493	2,484	400
Eola-Robberson, 1921	889	135,795	5,539	365	Keystone, 1930	1,353	317,491	6,475	641
Fitts, 1933	1,999	206,954	11,976	527	Mabee, 1943	2,214	93,835	10,712	381
Glenn Pool, 1905	600	330,202	4,619	485	McElroy, 1926	8,201	488,497	33,852	1,856
Golden Trend, 1945	3,287	484,578	20,449	1,177	Means, 1934	5,575	246,058	24,616	701
Heraldton, 1913	1,425	339,703	10,110	922	Midland Farms, 1944	2,281	250,407	10,189	281
Hewitt, 1919	1,869	274,215	12,511	703	Penwell, 1926	1,830	113,706	13,655	388
Little River, 1927	166	141,458	1,495	73	Sand Hills, 1931	1,925	254,544	15,263	1,123
Oklahoma City, 1928	1,040	819,385	9,750	190	Shafter Lake, 1947	1,123	98,741	7,914	448
Postle, 1960	901	109,484	11,830	216	TXL, 1944	1,311	267,793	8,492	534
Seminole, 1926	289	193,712	1,643	143	Waddell, 1927	455	102,319	4,279	183
Sho-Vel-Tum, 1919	15,180	1,216,216	84,784	6,370	Ward, S., 1938	504	106,649	3,811	630
Sooner Trend, 1965	3,131	305,872	20,091	2,964	Ward Estes, N., 1929	3,855	374,883	65,750	1,340
St. Louis, 1925	859	176,871	4,065	441	Westbrook, 1920	1,940	94,044	9,960	545
TEXAS					Yates, 1926	19,401	1,240,574	112,985	1,021
Dist. 1—Southwest					Dist. 8A—West				
Darst Creek, 1929	511	155,770	3,412	880	Adair, 1947	969	110,167	7,908	145
Luling-Branyon, 1922	925	150,450	4,725	1,671	Anton-Irish, 1944	2,512	184,922	15,593	242
Pearsall, 1936	20,576	113,011	39,782	1,059	Cogdell, 1949	947	295,632	7,790	184
Dist. 2—Central Gulf Coast					Diamond M, 1948	1,407	244,009	11,472	282
Greta, 1933	413	148,971	2,511	75	Garza, 1926	2,550	113,045	20,088	535
Lake Pasture, 1953	1,683	92,853	7,575	188	Kelly-Snyder, 1948	7,419	1,269,443	80,557	677
Tom O'Connor, 1934	5,319	765,414	27,367	659	Levelland, 1938	16,000	532,742	84,752	3,023
West Ranch, 1938	1,624	385,720	7,915	235	Prentice, 1951	5,112	178,458	34,317	395
Dist. 3—Upper Gulf Coast					Salt Creek, 1950	9,042	276,812	52,119	189
Anahuac, 1935	495	286,717	2,538	79	Seminole, 1936	16,015	573,458	94,834	454
Barbers Hill, 1916	309	111,942	1,895	88	Slaughter, 1936	16,837	1,082,143	118,958	2,575
Conroe, 1931	1,922	734,168	11,195	226	Spraberry Trend, 1951	18,255	709,104	105,313	7,475
Giddings, 1971	12,777	293,761	55,313	2,299	Wasson, 1936	27,717	1,795,359	109,638	2,273
Goose Creek, 1906	655	119,479	3,862	193	Weich, 1942	2,830	153,034	23,211	779
Hastings East, 1934	1,530	698,615	8,676	139	Dist. 9—North				
High Island, 1922	362	136,156	1,659	95	Archer County Reg., 1911	1,417	182,515	7,439	4,041
Hull, 1918	425	168,842	4,076	248	Cooke County Reg., 1926	899	102,836	4,265	1,432
Humble, 1905	154	98,703	1,240	175	K-M-A, 1931	890	142,298	3,991	713
Magnet Withers, 1936	1,315	115,146	8,350	142	Walnut Bend, 1938	470	124,591	2,635	142
Manvel, 1931	425	101,289	2,027	70	Wichita County Reg., 1910	2,489	339,888	13,977	7,163
Oyster Bayou, 1941	520	182,109	2,888	27	Wilbarger County Reg., 1915	665	147,215	3,519	1,000
Raccoon Bend, 1927	486	101,868	2,499	110	Young County Reg., 1917	1,196	101,225	5,778	2,886
Sour Lake, 1902	1,066	98,492	8,361	362	Dist. 10—Panhandle				
Thompson, 1921	1,941	480,330	12,717	178	Panhandle, 1921	6,105	1,442,247	23,910	10,883
Tomball, 1933	250	121,884	1,493	55	UTAH				
Webster, 1937	2,948	583,623	19,155	186	Altamont, 1955	3,027	97,974	24,607	434
West Columbia, 1917	84	101,249	650	36	Greater Aneth, 1956	5,101	370,388	27,854	464
Dist. 4—South					Bluebell, 1949	3,587	120,933	23,917	215
Agua Dulce-Stratton, 1928	124	147,238	2,262	58	WYOMING				
Borregos, 1945	116	114,470	1,009	29	Byron, 1918	770	123,214	5,071	58
Kelsey, 1938	199	115,423	1,216	55	Eik Basin, 1915	2,409	439,854	17,762	178
Plymouth, 1925	190	123,447	2,676	40	Frannie, 1928	613	118,192	2,747	64
Seligson, 1925	185	272,048	1,001	48	Garland, 1936	2,460	170,417	11,713	234
TCB, 1944	45	113,141	500	11	Grass Creek, 1914	1,916	191,554	11,026	243
White Point, E., 1938	101	104,349	711	41	Hamilton Dome, 1918	2,287	237,512	13,166	248
Dist. 5—East					Hartzog Draw, 1976	3,969	80,892	24,232	180
Van, 1928	2,675	530,243	13,225	405	Hilght, 1969	401	76,800	4,498	92
Dist. 6—East					Lance Creek, 1918	140	108,219	1,356	25
East Texas, 1930	33,119	5,112,891	248,918	8,334	Little Buffalo Basin, 1914	1,695	124,865	8,868	171
Fairway, 1960	1,806	196,424	12,044	104	Lost Soldier, 1916	4,055	218,899	35,717	91
					Oregon Basin, 1912	6,712	410,351	58,178	523
					Salt Creek, 1889	3,815	642,406	25,810	1,014
					Steamboat Butte, 1943	601	91,655	10,125	37
					Wertz, 1921	1,804	107,671	22,874	48

Sources: OGJ estimates from operator, Petroleum Information Corp., state geological survey, and oil and gas agency data.
e-field partially or wholly offshore



World gas production (bcf)

Country	1991*	Country	1991*
Argentina	747.3	Algeria	1,620.1
Bolivia	106.9	Angola	20.4
Brazil	101.5	Egypt	264.2
Canada	4,143.1	Gabon	3.6
Chile	29.8	Libya	228.5
Colombia	143.6	Nigeria	114.8
Ecuador	3.6	Tunisia	14.3
Mexico	1,349.6	Other Africa	1.2
Peru	45.3	Africa	2,287.1
Trinidad	164.6	Bahrain	159.5
United States	18,588.0	Iran	781.0
Venezuela	1,002.7	Iraq	21.6
Other Latin America	1.1	Kuwait	15.1
Western Hemisphere	26,427.1	Oman	91.2
Austria	44.7	Qatar	253.1
Denmark	133.5	Saudi Arabia	1,590.0
France	121.5	Syria	47.0
Germany	966.3	United Arab Emirates	1,163.8
Greece	3.6	Other Middle East	6.8
Ireland	88.6	Middle East	4,129.1
Italy	712.0	Australia	756.8
Netherlands	2,919.6	Brunei	292.1
Norway	869.1	China	534.1
Spain	46.7	India	476.5
Turkey	7.1	Indonesia	1,362.6
United Kingdom	1,954.0	Japan	56.7
Western Europe	7,866.7	Malaysia	584.8
Albania	24.6	Myanmar (Burma)	34.9
Hungary	184.4	New Zealand	146.8
Romania	965.5	Pakistan	508.6
U.S.S.R.	26,660.0	Thailand	265.4
Yugoslavia	94.5	Other Asia-Pacific	213.8
Other Eastern Europe	186.4	Asia-Pacific	6,233.1
Eastern Europe & U.S.S.R.	30,115.4	TOTAL WORLD	76,638.6

*Estimated

Crude oil prices

Year	\$/bbl												
	U.S. refiner acquisition cost			U.S. landed cost of imports						Average export prices			
	Domestic	Imported	Compo- site	Total	Selected countries				Saudi Arabia	Vene- zuela	World- wide	OPEC	Non- OPEC
					Canada	Mexico	United Kingdom	Nigeria					
1976	8.84	13.48	10.89	13.34	13.57	NA	NA	13.80	13.04	11.80	NA	NA	NA
1977	9.55	14.53	11.96	14.31	14.21	13.75	NA	15.25	13.61	13.13	NA	NA	NA
1978	10.61	14.57	12.46	14.38	14.50	13.54	NA	14.86	13.92	12.83	NA	NA	NA
1979	14.27	21.67	17.72	21.65	20.43	20.86	22.16	22.96	19.15	18.18	NA	NA	NA
1980	24.29	33.89	28.07	33.95	30.47	31.80	35.88	37.05	30.02	25.86	NA	NA	NA
1981	34.93	37.05	35.24	36.52	32.16	33.78	37.24	39.70	34.19	29.87	34.81	34.42	36.16
1982	31.22	33.55	31.87	33.18	26.92	26.64	34.28	36.17	35.00	24.82	33.33	33.71	32.3
1983	28.87	29.30	28.99	28.93	25.63	25.78	30.87	30.84	29.76	22.94	29.66	29.89	29.13
1984	28.53	28.88	28.63	28.46	26.59	26.87	29.60	30.50	29.50	25.15	28.60	28.61	28.6
1985	26.66	26.99	25.75	26.66	25.71	25.63	28.35	28.96	24.72	24.43	27.60	28.00	26.98
1986	14.82	14.00	14.55	13.49	13.43	12.17	14.63	15.29	12.84	11.52	14.98	15.45	14.21
1987	17.76	18.13	17.90	17.65	17.04	16.69	18.78	19.32	16.81	15.76	17.41	17.31	17.57
1988	14.74	14.56	14.67	14.08	15.15	12.58	15.82	15.88	13.37	13.66	13.79	13.67	14.04
1989	17.87	18.08	17.97	17.68	18.35	16.35	18.74	19.19	17.34	16.78	16.65	16.40	17.11
1990	22.60	21.78	22.23	21.16	22.42	19.63	22.68	23.38	21.89	20.31	21.35	20.98	22.07

From: Oil & Gas Journal Energy Database
Source: U.S. Department of Energy

Petroleum product prices

Year	Motor gasoline-pump price					Refiner resale (wholesale) product prices							
	(\$/gallon)												
	Leaded Regular	Unleaded Regular	Unleaded Premium	Average All-Types	Heating Oil Residential	Motor Gasoline	Aviation Gasoline	Kerosene Jet Fuel	Kerosene	No. 2 Fuel Oil	No. 2 Diesel Oil	Propane	Resid
1978	62.60	67.00	NA	65.20	49.00	43.40	53.70	38.60	40.40	36.90	36.50	23.70	26.30
1979	85.70	90.30	NA	88.20	70.40	63.70	72.10	66.00	62.40	56.90	57.40	29.10	39.90
1980	119.10	124.50	NA	122.10	97.40	94.10	112.80	86.80	86.40	80.30	80.10	41.50	52.80
1981	131.10	137.80	147.00	135.30	119.40	106.40	125.00	101.20	106.60	97.60	97.20	46.60	66.30
1982	122.20	129.60	141.50	128.10	116.00	97.30	122.80	95.30	101.80	91.40	91.40	42.70	61.20
1983	115.70	124.10	138.30	122.50	107.80	88.20	117.80	85.40	89.20	81.50	80.80	48.40	60.90
1984	112.90	121.20	136.60	119.80	109.10	83.20	116.50	83.00	91.60	82.10	80.30	45.00	65.40
1985	111.50	120.20	134.00	119.60	105.30	83.50	113.00	79.40	87.40	77.60	77.20	39.80	57.70
1986	85.70	92.70	108.50	93.10	83.60	53.10	91.20	49.50	60.80	48.60	45.20	29.00	30.50
1987	89.70	94.80	109.30	95.70	80.30	58.90	85.90	53.80	59.20	52.70	53.40	25.20	38.50
1988	89.90	94.60	110.70	96.30	81.30	57.70	85.00	49.50	54.90	47.30	47.30	24.00	30.00
1989	99.80	102.10	119.70	106.00	90.00	65.40	95.00	58.30	66.90	56.50	56.70	24.70	36.00
1990	114.90	116.40	134.90	121.70	106.20	78.60	106.30	77.30	83.90	69.70	69.40	38.70	41.20

From: Oil & Gas Journal Energy Database
Source: U.S. Department of Energy

Comparative energy prices

Year	Natural gas delivered to consumers					Cost of fossil fuels delivered to utilities				Electricity retail prices			
	(\$/MCF)					(\$/Million BTU)				(\$/Kilowatt Hour)			
	Residential	Commercial	Industrial	Electric Utilities	Average	Coal	Heavy oil	Natural gas	All fuels	Residential	Commercial	Industrial	Total
1973	1.29	0.94	0.50	0.38	0.68	40.5	78.5	33.8	47.6	2.54	2.41	1.25	1.96
1974	1.46	1.07	0.67	0.51	0.84	70.9	189.0	48.2	91.4	3.10	3.04	1.69	2.49
1975	1.71	1.35	0.96	0.77	1.12	81.4	200.5	75.2	104.4	3.51	3.45	2.07	2.92
1976	1.98	1.64	1.24	0.98	1.37	84.8	195.2	103.4	111.9	3.73	3.69	2.21	3.09
1977	2.35	2.04	1.50	1.32	1.66	94.7	219.8	129.1	129.7	4.05	4.09	2.50	3.42
1978	2.56	2.23	1.70	1.48	1.85	111.6	212.5	142.2	141.1	4.31	4.36	2.79	3.69
1979	2.98	2.73	1.99	1.81	2.21	122.4	298.8	174.9	163.9	4.64	4.66	3.05	3.99
1980	3.68	3.39	2.56	2.27	2.80	135.1	426.7	219.9	192.8	5.36	5.48	3.69	4.73
1981	4.29	4.00	3.14	2.89	3.39	153.2	533.4	280.5	225.6	6.20	6.29	4.29	5.46
1982	5.17	4.82	3.87	3.48	4.15	164.70	483.0	337.6	224.9	6.86	6.86	4.95	6.13
1983	6.06	5.59	4.18	3.58	4.82	165.60	457.0	347.4	220.6	7.18	7.01	4.97	6.29
1984	6.12	5.55	4.22	3.70	4.85	166.40	481.0	360.3	219.1	7.54	7.33	5.04	6.52
1985	6.12	5.50	3.95	3.55	4.72	164.8	424.4	344.4	209.4	7.79	7.47	5.16	6.71
1986	5.83	5.08	3.23	2.43	4.13	157.9	240.1	235.1	175.0	7.41	7.13	4.90	6.42
1987	5.54	4.77	2.94	2.32	4.05	150.6	297.6	224.0	170.6	7.41	7.01	4.72	6.32
1988	5.47	4.63	2.95	2.33	4.09	146.6	240.5	226.3	164.3	7.49	7.07	4.62	6.31
1989	5.64	4.74	2.96	2.43	4.22	144.5	284.6	235.5	167.5	7.64	7.23	4.69	6.43
1990	5.80	4.82	2.93	2.38	4.19	145.5	331.9	232.1	168.9	7.85	7.33	4.74	6.56

From Oil & Gas Journal Energy Database
Source: U.S. Department of Energy

Price history, crude oil, natural gas and motor gasoline

Year	Actual current prices						Inflation adjusted real prices				
	Crude oil			Natural gas			Crude oil		Natural gas		
	U.S. average wellhead \$/bbl	West Texas Intermediate posted \$/bbl	Motor Gasoline loaded pump price \$/gal	U.S. average wellhead \$/Mcf	Consumer average \$/Mcf	Producer Price Index 1982-100	U.S. average wellhead \$/bbl	West Texas Intermediate posted \$/bbl	Motor Gasoline loaded pump price \$/gal	U.S. average wellhead \$/Mcf	Consumer average \$/Mcf
1925	1.68	1.79	0.222	0.094	0.223	17.8	9.438	10.056	1.247	0.528	1.253
1926	1.88	1.90	0.234	0.095	0.229	17.2	10.930	11.047	1.359	0.552	1.311
1927	1.30	1.28	0.211	0.088	0.220	16.5	7.879	7.758	1.278	0.533	1.333
1928	1.17	1.36	0.209	0.089	0.232	16.7	7.006	8.144	1.254	0.533	1.389
1929	1.27	1.45	0.214	0.082	0.216	16.4	7.744	8.841	1.306	0.500	1.317
1930	1.19	0.95	0.200	0.076	0.214	14.9	7.987	6.376	1.339	0.510	1.436
1931	0.65	0.77	0.170	0.070	0.233	12.6	5.159	6.111	1.348	0.556	1.849
1932	0.87	0.69	0.179	0.064	0.247	11.2	7.768	6.161	1.601	0.571	2.205
1933	0.67	1.00	0.178	0.062	0.237	11.4	5.877	8.772	1.563	0.544	2.079
1934	1.00	1.00	0.189	0.060	0.223	12.9	7.752	7.752	1.461	0.465	1.729
1935	0.97	1.00	0.188	0.058	0.224	13.8	7.029	7.246	1.365	0.420	1.623
1936	1.09	1.10	0.195	0.055	0.220	13.9	7.842	7.914	1.399	0.396	1.582
1937	1.18	1.22	0.200	0.051	0.220	14.9	7.919	8.188	1.342	0.342	1.477
1938	1.13	1.02	0.195	0.049	0.218	13.5	8.370	7.556	1.445	0.363	1.615
1939	1.02	1.02	0.188	0.049	0.216	13.3	7.669	7.699	1.410	0.368	1.624
1940	1.02	1.02	0.184	0.045	0.217	13.5	7.556	7.556	1.364	0.333	1.607
1941	1.14	1.17	0.192	0.049	0.221	15.1	7.550	7.748	1.274	0.325	1.464
1942	1.19	1.17	0.204	0.051	0.227	17.0	7.000	6.882	1.202	0.300	1.335
1943	1.20	1.17	0.205	0.052	0.223	17.8	6.742	6.573	1.153	0.292	1.253
1944	1.21	1.17	0.206	0.051	0.215	17.9	6.760	6.536	1.150	0.285	1.201
1945	1.22	1.17	0.205	0.049	0.214	18.2	6.703	6.429	1.128	0.269	1.176
1946	1.41	1.36	0.208	0.053	0.220	20.8	6.779	6.524	0.999	0.255	1.058
1947	1.93	1.84	0.231	0.060	0.232	25.6	7.539	7.188	0.903	0.234	0.906
1948	2.60	2.57	0.259	0.065	0.241	27.7	9.386	9.278	0.954	0.235	0.870
1949	2.54	2.57	0.268	0.063	0.254	26.3	9.658	9.772	1.019	0.240	0.966
1950	2.51	2.57	0.268	0.065	0.266	27.3	9.194	9.414	0.980	0.238	0.974
1951	2.53	2.57	0.272	0.073	0.298	30.4	8.322	8.454	0.893	0.240	0.980
1952	2.53	2.57	0.276	0.078	0.332	29.6	8.547	8.682	0.931	0.264	1.122
1953	2.68	2.72	0.287	0.092	0.355	29.2	9.178	9.298	0.983	0.315	1.216
1954	2.78	2.82	0.290	0.101	0.381	29.3	9.488	9.625	0.991	0.345	1.300
1955	2.77	2.82	0.291	0.104	0.400	29.3	9.454	9.625	0.992	0.355	1.365
1956	2.79	2.82	0.299	0.108	0.415	30.3	9.208	9.307	0.988	0.356	1.370
1957	3.09	3.04	0.310	0.113	0.431	31.2	9.904	9.753	0.992	0.362	1.381
1958	3.01	3.06	0.304	0.119	0.462	31.6	9.525	9.677	0.961	0.377	1.462
1959	2.90	2.98	0.305	0.129	0.477	31.7	9.148	9.385	0.962	0.407	1.505
1960	2.88	2.97	0.311	0.140	0.500	31.7	9.085	9.369	0.982	0.442	1.577
1961	2.89	2.97	0.308	0.151	0.510	31.6	9.146	9.399	0.973	0.478	1.614
1962	2.90	2.97	0.306	0.155	0.514	31.7	9.148	9.369	0.967	0.489	1.621
1963	2.89	2.97	0.304	0.158	0.512	31.6	9.146	9.399	0.963	0.500	1.620
1964	2.88	2.95	0.304	0.154	0.519	31.6	9.114	9.320	0.962	0.487	1.642
1965	2.86	2.92	0.312	0.156	0.522	32.3	8.854	9.040	0.966	0.483	1.616
1966	2.88	2.94	0.321	0.157	0.523	33.3	8.649	8.817	0.964	0.471	1.571
1967	2.92	3.03	0.332	0.160	0.520	33.4	8.743	9.060	0.994	0.479	1.557
1968	2.94	3.07	0.337	0.164	0.504	34.2	8.596	8.977	0.985	0.480	1.474
1969	3.09	3.30	0.348	0.167	0.515	35.6	8.680	9.256	0.978	0.469	1.447
1970	3.18	3.35	0.357	0.171	0.550	36.9	8.618	9.079	0.967	0.463	1.491
1971	3.39	3.56	0.364	0.182	0.590	38.0	8.921	9.368	0.958	0.479	1.553
1972	3.39	3.56	0.361	0.186	0.630	39.8	8.518	8.945	0.907	0.467	1.583
1973	3.89	3.87	0.388	0.216	0.680	45.0	8.644	8.604	0.862	0.480	1.511
1974	6.74	10.37	0.532	0.304	0.840	53.5	12.598	19.383	0.994	0.568	1.570
1975	7.56	11.16	0.567	0.445	1.120	58.4	12.945	19.110	0.971	0.762	1.918
1976	8.14	12.65	0.590	0.580	1.370	61.1	13.322	20.704	0.966	0.949	2.242
1977	8.57	14.30	0.622	0.790	1.660	64.9	13.205	22.034	0.958	1.217	2.558
1978	8.96	14.85	0.626	0.905	1.850	69.9	12.318	21.245	0.896	1.295	2.647
1979	12.51	22.40	0.857	1.178	2.210	78.7	15.896	28.463	1.089	1.497	2.808
1980	21.59	37.37	1.191	1.590	2.800	89.7	24.069	41.661	1.328	1.773	3.122
1981	31.77	36.67	1.311	1.980	3.390	98.0	32.418	37.418	1.338	2.020	3.459
1982	28.52	32.75	1.222	2.460	4.150	100.0	28.520	32.750	1.222	2.460	4.150
1983	26.19	30.25	1.157	2.590	4.820	101.2	25.879	29.891	1.143	2.559	4.763
1984	25.88	29.83	1.129	2.660	4.850	103.6	24.981	28.793	1.090	2.568	4.681
1985	24.09	28.08	1.115	2.510	4.720	103.1	23.366	27.236	1.081	2.435	4.578
1986	12.51	16.44	0.857	1.940	4.130	100.1	12.498	16.421	0.856	1.938	4.046
1987	15.40	18.21	0.897	1.670	4.050	102.8	14.981	17.714	0.873	1.625	3.940
1988	12.58	15.52	0.899	1.690	4.090	106.9	11.768	14.518	0.841	1.581	3.826
1989	15.86	18.29	0.998	1.690	4.220	112.2	14.135	16.301	0.889	1.506	3.761
1990	20.03	23.17	1.149	1.710	4.190	116.3	17.223	19.923	0.988	1.470	3.603

From: Oil & Gas Journal Energy Database
Source: U.S. Department of Energy

PIPELINING

MMcfd of mostly Rocky Mountain gas to fuel enhanced oil recovery projects near Bakersfield, Calif. The 676 mile line begins near Northwest Pipeline Inc.'s Opal, Wyo., gas processing plant and merges with a sister project at the California line.

Kern River plans to add another 452 MMcfd of capacity with a \$308 million project to provide transportation for shippers selling Canadian gas into California markets through Altamont Gas Transmission Co.'s proposed pipeline.

Completion of Kern River's proposed expansion is to coincide with Altamont's expected start-up in November 1993. Nine firm shippers have fully subscribed the expanded capacity.

The 30 in. Altamont pipeline is to run 620 miles from the Canadian border crossover at Wild Horse, Mont., and join Kern River near Opal. It is envisioned to transport as much as 719 MMcfd.

Another project to move Canadian gas to California began preliminary construction late in 1991, targeting completion by November 1993.

Pacific Gas & Electric Co. and Pacific Gas Transmission Co. were pushing a \$1.5 billion, 844 mile expansion of the PGT line from the Idaho-Alberta border to a point near Panoche, Calif.

Project sponsors are installing in 1992 almost 480 miles of 42 in. line. In 1993 they expect to complete the pipeline with more than 210 miles of 42 in.

The expansion will move more than 900 MMcfd of Canadian gas to a California market estimated to need an additional 2.1 bcf/d by 2010.

Gas pipeline capacity out of the San Juan basin in New Mexico jumped by more than 1.3 bcf/d in 1992 when projects by El Paso Natural Gas Co. and Transwestern Pipeline Co. were completed.

Transwestern began service on a 520 MMcfd lateral out of San Juan and a 340 MMcfd expansion of its main line.

The San Juan lateral consists of a 100 mile, 30 in. pipeline from a new compressor station near Blanco, N.M., to a connection with Transwestern's main line near Thoreau, N.M. For the expansion, the company laid 200 miles of 30 in. loop and made minor changes at compressor stations.

The project will run to more than \$258 million—\$165 million for the main line expansion and \$93 million for the lateral.

El Paso began operating 835 MMcfd of added capacity out of the San Juan basin. The \$241.5 million expansion increased El Paso's system capacity to 2.5 bcf/d for gas leaving San Juan. About 400 MMcfd of new capacity is available on the company's westbound main line.

Installation of bidirectional transportation allows El Paso to move 435 MMcfd of gas east on its Permian basin-San Juan basin crossover.

Two pipeline projects proposed in the southeastern U.S. will increase gas supplies to Florida. A smaller project will provide an important outlet for gas leaving the Mobile Bay area off Alabama.

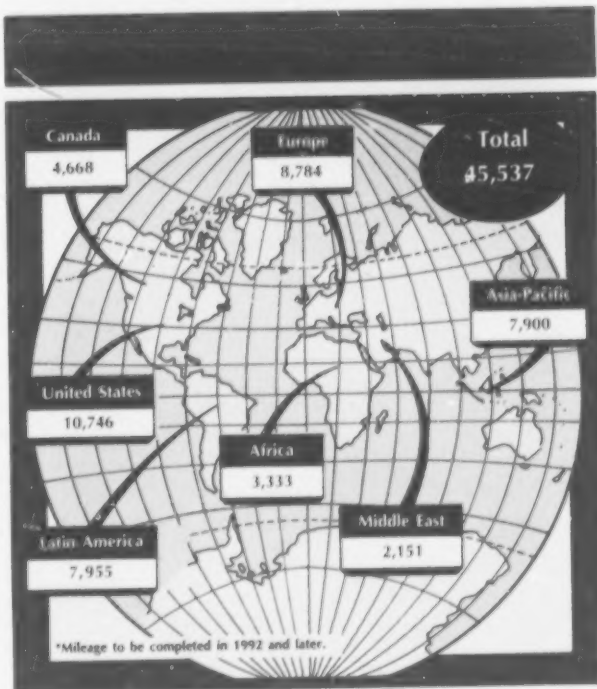
United Gas Pipe Line Co. (UGPL) began moving gas through Gateway Pipeline. The \$22 million, 30 in. line moves as much as 600 MMcfd of gas 25 miles from treatment plants in southern Mobile County, Ala., to UGPL's 30 in. Lirette pipeline.

Gateway capacity can be increased to 1.2 bcf/d by adding compression.

UGPL and ANR Southern Pipeline Co., a unit of Coastal Corp., were expected by midyear to file an application to construct SunCoast Pipeline, a 560 mile intrastate pipeline that at first will add about 400 MMcfd of gas to Florida markets.

Capacity on the \$800 million system can be expanded to 1.2 bcf/d with additional compression.

SunCoast will transport gas from UGPL's system terminus



near Pensacola in the Florida Panhandle to markets in northern and central parts of the state. UGPL and ANR expect to begin construction of the new line in July 1993 and to begin transporting gas in November 1994.

Florida Gas Transmission filed with the FERC late in 1991 for a permit nearly to double system capacity by as much as 875 MMcfd to serve the Tampa-St. Petersburg area. Cost of the project is estimated at \$940.

Florida also will be the site of a products pipeline project.

In 1993 GATX Terminals plans to lay a 125 mile, 10 in. products pipeline in Florida to be known as the Southwest Florida Pipeline Co.

Koch Hydrocarbons also plans a 583 mile, 12 in., 100,000 b/d products line from Medford, Okla., to Mont Belvieu, Tex.

It will connect Koch's 170,000 b/d Medford fractionator with Gulf Coast petrochemical markets. The line replaces an 8 in., 40,000 b/d line which will be converted to a crude oil gathering line.

Seminole Pipeline will add a 14 in., 535 mile line to its NGL system from Gaines County in West Texas to Mont Belvieu. Operational target date for the line is first quarter 1993, increasing capacity to more than 300,000 b/d from its current 140,000 b/d.

North Sea projects

In the North Sea, work continues on the first phase of the Zeepipe system, a 500 mile, 40 in. line from Sleipner to Zeebrugge, Belgium, a 25 mile, 30 in. link to the Statpipe riser platform on Block 16/11, and the 140 mile, 20 in. condensate line to Karsto, Norway.

Zeepipe's second phase, a 184 mile, 40 in. extension, will be built to the Troll gas terminal. Start-up is anticipated in 1996.

A third major gas pipeline from the North Sea to continental Europe is planned by Zeepipe partners. The 403 mile Europipe will extend from the Statpipe riser platform to a point near Emden, Germany. It could be operating as early as 1995.

Statoil has announced pipe orders for the latter two projects.

PIPELINING

Pipeline costs: estimated vs. actual, 1989-91*

Size, in., and location	Length, miles	Costs, \$					Total	\$/mile
		Materials	Labor	Misc.	R.O.W. & damages			
Land pipelines								
6 Kentucky	4.88							
Estimated		411,900	557,300	1,454,100	16,500	2,439,800	499,959	
Actual		277,450	792,410	1,115,010	11,360	2,186,230	450,047	
8 Tennessee (L)	1.10							
Estimated		76,500	130,580	39,070	25,850	242,000	220,000	
Actual		72,668	110,603	40,275	15,542	239,088	217,353	
8 Wyoming	435							
Estimated		311,000	287,000	183,940	16,000	797,940	183,434	
Actual		317,544	322,998	121,508	11,425	773,475	177,810	
10 Connecticut	0.90							
Estimated		180,500	707,200	586,100	141,200	1,595,000	1,772,222	
Actual		159,862	742,831	546,174	175,300	1,624,277	1,804,752	
10 Massachusetts	0.54							
Estimated		83,200	204,450	71,510	1,000	340,160	629,926	
Actual		71,411	214,538	72,705	980	359,635	665,991	
12 Oklahoma	12.40							
Estimated		977,000	715,500	275,050	386,700	2,354,250	189,859	
Actual		839,000	690,600	276,000	563,000	2,368,600	191,018	
16 Pennsylvania (L)	2.25							
Estimated		511,101	852,445	332,254	35,450	1,751,250	778,333	
Actual		512,864	935,814	433,105	58,015	1,990,799	871,021	
16 North Carolina	7.50							
Estimated		776,700	2,159,600	758,111	185,700	3,880,111	517,348	
Actual		701,464	1,931,589	432,096	116,335	3,181,484	424,198	
16 Indiana (L)	59.01							
Estimated		6,274,000	7,767,000	2,798,520	1,302,000	18,141,520	307,431	
Actual		5,822,704	10,980,941	2,719,060	1,459,982	20,982,657	355,578	
20 Texas-Louisiana	5.60							
Estimated		964,000	786,000	245,000	90,000	2,085,000	368,964	
Actual		856,828	597,736	198,043	148,967	1,801,575	321,710	
20 Kentucky (L)	3.42							
Estimated		515,000	603,000	162,620	81,000	1,361,620	398,135	
Actual		436,586	653,432	210,455	31,364	1,331,836	389,428	
20 Indiana (L)	66.28							
Estimated		9,814,000	10,639,000	3,824,920	1,966,000	26,045,920	381,458	
Actual		8,517,186	14,002,414	4,233,469	3,852,477	30,405,548	445,307	
20 Utah	81.00							
Estimated		9,042,950	6,434,600	3,869,100	386,900	19,715,550	241,812	
Actual		8,536,743	10,713,206	5,247,886	324,345	24,822,180	304,193	
22 Tennessee (C)	0.48							
Estimated		325,000	857,600	375,080	8,000	1,566,280	3,263,083	
Actual		324,473	1,213,038	186,036	1,285	1,724,832	3,593,400	
24 Pennsylvania	27.60							
Estimated		4,486,500	7,584,800	1,832,700	1,456,000	15,120,000	547,826	
Actual		4,113,100	12,035,500	2,115,360	259,800	18,523,600	671,145	
30 Pennsylvania (L)	5.15							
Estimated		1,921,425	2,870,686	1,162,869	82,400	6,037,400	1,172,311	
Actual		1,922,747	2,477,263	966,285	99,942	5,499,247	1,067,815	
36 Pennsylvania (L)	8.22							
Estimated		4,190,223	4,786,946	2,084,981	263,300	11,335,450	1,379,008	
Actual		4,413,958	5,103,026	2,402,903	336,162	12,256,049	1,491,004	
42 Georgia	12.05							
Estimated		5,462,610	3,995,160	2,592,480	327,760	12,378,020	1,027,221	
Actual		5,103,683	5,667,962	3,581,906	359,958	14,713,700	1,221,055	
48 Alabama	15.17							
Estimated		8,743,954	5,975,585	3,973,679	461,130	19,154,348	1,262,647	
Actual		8,757,285	6,147,753	4,825,912	404,593	20,135,543	1,327,326	
Total land	329.80							
Estimated		\$64,767,583	\$67,644,462	\$36,462,714	\$7,216,880	\$146,211,819	\$446,511	
Actual		\$51,767,778	\$76,333,656	\$39,777,036	\$8,030,892	\$184,898,363	\$514,507	
Offshore pipelines								
10 Louisiana	4.02							
Estimated		372,739	542,080	387,809	100	1,312,728	326,549	
Actual		439,720	716,394	225,763	102	1,383,979	344,273	
16 Louisiana	10.22							
Estimated		1,762,344	1,225,800	1,142,086	245	4,129,485	404,059	
Actual		1,554,487	1,293,540	562,560	172	3,410,759	333,734	
16 Louisiana	26.57							
Estimated		4,965,097	3,195,783	2,867,210	499	11,048,589	415,829	
Actual		4,989,580	4,181,227	1,315,608	478	10,496,993	394,689	
20 Louisiana	25.39							
Estimated		4,645,439	5,134,036	3,415,440	478	13,195,393	519,708	
Actual		4,659,377	4,821,543	1,389,179	419	10,869,817	428,547	
24 Louisiana	20.03							
Estimated		7,809,000	5,200,000	2,237,830	—	15,246,830	761,200	
Actual		7,421,000	7,916,900	2,746,900	—	18,084,800	902,886	
Total offshore	86.23							
Estimated		\$16,554,519	\$16,297,701	\$10,678,386	\$1,320	\$44,933,626	\$821,083	
Actual		\$19,064,164	\$18,631,964	\$8,289,688	\$1,171	\$44,947,248	\$813,131	
Total land + offshore	416.03							
Estimated		\$74,282,102	\$73,142,163	\$46,532,699	\$7,218,210	\$191,244,944	\$470,299	
Actual		\$70,831,942	\$94,965,620	\$48,067,724	\$8,032,063	\$219,148,611	\$514,215	

Sources: U.S. FERC completed-project cost filings, Jan. 1, 1989, to June 30, 1991, under CFR Section 167.20(c)(4).

*Actual cost data must be filed within 6 months following final hydrostatic test of pipeline. Not all projects proposed (estimated costs) are built (actual costs). L = Loop; C = River or channel crossing.

†Generally includes engr., superv., surveying, interest, administration and overheads, contingencies, and FERC fees.

Natural gas pipeline transmission expenses*

	Expenses, \$		Cost/mile, \$		Cost/MMcf sold, \$	
	1988- majors†	1989- majors‡	1988- majors†	1989- majors‡	1988- majors†	1989- majors‡
Operation expenses						
Supervision and engineering	166,584,029	176,198,733	661.37	693.53	26.16	31.69
System control and load dispatching	29,284,519	33,213,655	116.26	130.73	4.60	5.97
Communication system expenses	30,224,686	31,600,547	120.00	124.38	4.75	5.66
Compressor station labor and expenses	269,976,844	296,448,577	1,071.96	1,166.85	42.39	53.32
Gas for compressor-station fuel	375,692,286	376,908,680	1,492.36	1,483.90	59.02	67.61
Other fuel and power for compressor stations	65,481,393	54,138,692	259.97	213.09	10.28	9.74
Mains	182,166,091	174,280,381	723.23	685.98	28.60	31.35
Measuring and regulating station expenses	61,872,085	64,760,794	245.64	254.90	9.72	11.65
Transmission and compression of gas by others	936,299,992	854,273,433	3,717.28	3,362.50	147.02	153.66
Other transmission expenses	40,409,766	53,942,932	160.43	212.32	6.35	9.70
Rents	19,796,436	21,199,398	78.80	83.44	3.11	3.81
Total operation expenses	\$2,177,988,127	\$2,137,955,822	\$8,847.86	\$8,411.86	\$341.98	\$384.46
Maintenance expenses						
Supervision and engineering	31,519,867	34,610,110	125.14	136.23	4.95	6.23
Structures and improvements	22,517,885	20,767,763	89.40	81.74	3.54	3.74
Mains	109,462,229	114,999,238	434.58	452.65	17.19	20.69
Compressor-station equipment	218,175,493	251,193,978	866.20	988.72	34.26	45.18
Measuring and regulating station equipment	13,202,645	14,567,775	52.42	57.34	2.07	2.62
Communication equipment	11,906,439	10,414,463	47.27	40.99	1.87	1.87
Other equipment	4,036,815	5,669,129	16.03	22.31	0.63	1.02
Total maintenance expenses	\$410,821,393	\$452,222,486	\$1,631.63	\$1,779.99	\$64.51	\$81.34
Total transmission expenses	\$2,588,809,520	\$2,590,178,308	\$10,479.49	\$10,191.84	\$406.49	\$465.79
Total miles of transmission pipeline	261,678	254,059				
Total natural gas sold, MMcf	6,368,682	6,558,409				

Source: Statistics of Interstate Natural Gas Pipeline Companies—1988 & 1989, U.S. Department of Energy. *U.S. interstate pipelines for calendar years 1988 & 1989. † 46 of 135 companies filing Forms 2s or 2As with the U.S. FERC for 1988; majors are companies whose combined gas sold for resale and gas transported or stored for a fee exceed 50 bcf (at 14.7 psi; 60° F.) in each of the 3 previous calendar years. ‡ 45 of 144 companies filing Forms 2 or 2A with the U.S. FERC for 1989; majors defined in previous note and in U.S. FERC Accounting and Reporting Requirements for Natural Gas Companies, para. 20-011, effective Feb. 2, 1985, beginning with the 1984 reporting year (OGJ, Nov. 25, 1985, p. 80).

saga Petroleum AS disclosed plans for a 410-mile, 32-in. pipeline to move gas from its Haltenbanken development.

Other gas line action is related to the first export of gas from the British North Sea to continental Europe when Ultramar Exploration's Markham field begins deliveries in October 1992 through a 24-in. line.

Gas from the field, which straddles the boundary between the U.K. and Dutch sectors, will be split between Netherlands' Gasunie and Germany's Wintershall AG.

Exports to Gasunie alone will build to 37.3 bcf/year. Deliveries to Wintershall will start in 1993 and reach 15 bcf/year.

In other action, the Irish government approved a 170-mile gas pipeline across the Irish Sea to Scotland. A 70-mile onshore section will move gas into the Scottish grid.

That project is expected to cost about \$247 million. The state-owned Irish gas company could place contracts in 1992 with the offshore portion laid in 1993.

Germany, Mediterranean

Another major center of pipeline activity lies in Germany.

The two German giants in gas transportation—Wintershall and Ruhrgas AG—are scrambling to secure gas supplies and elbowing each other to lay pipelines into the eastern part of the country.

Ruhrgas started service in 1992 on a 37-mile link from Lauterback, Hesse, to Vitzroda, Thuringia. Another German pipeline company, EAG, started up its 186-mile line

from Vitzroda to Niederhohndorf, Saxony.

The gas in these systems is urgently needed to displace highly polluting lignite used by local industrial and commercial interests.

Wintershall is also completing in 1992 a 190-mile gas pipeline on its Stegal system into Czechoslovakia. The company expects to complete a 370-mile gas line from Emden to Ludvigshaven by the end of 1993.

And much more construction seems certain as more gas comes in from the North Sea and as Russian gas secures more customers in exchange for badly needed hard currency.

A considerable amount of work may be available on oil and gas line in the republics of the former Soviet Union. The poor condition of the massive gas lines bringing Russian gas to western Europe is common knowledge.

But the republics must find the cash to pay for the extensive rehabilitation work needed.

The condition of the system poses not only a safety and environmental headache, but with much of the system deteriorating, line pressures—and therefore throughputs—must be reduced. Reduced deliveries lead to reduced cash flow. That's not what the republics need.

Finally in Germany, a group led by Deutsche Shell AG plans to lay a 280-mile petroleum products line between the Hamburg refining center and Dresden in eastern Germany. The line has targeted 1994-95 for start-up.

Elsewhere, plans are advancing for a second trans-Mediterranean pipeline to move Algerian gas to Europe. A

U.S. Interstate pipeline mileage

Year	Gas	Miles Liquid	Total
1981	274,634	172,815	447,449
1982	286,999	172,549	459,548
1983	285,204	167,819	453,023
1984	*258,379	173,922	*432,301
1985	*279,395	171,401	*450,796
1986	*281,881	170,014	*451,895
1987	*280,085	167,865	*447,950
1988	*281,381	170,457	*451,838
1989	*273,481	168,637	*442,118
1990	*274,628	168,364	*442,992

Source: U.S. FERC Form 6, annual reports—oil pipelines, Forms 2 & 2A—gas pipelines.

*Reflects operating mileage as reported under the FERC's classification system for natural-gas pipeline companies effective beginning with the 1984 reporting year. Only major gas-pipeline companies are required to file mileage.

combine of six companies has undertaken a feasibility study for the 1,250 mile line from Algeria through Morocco and across the Mediterranean to Spain. The line could be operational by 2000.

Latin America, Asia-Africa

The last 44 miles of a 300 mile pipeline connecting Cusiana field in Colombia to Covenas is complete.

In January 1992, International Finance Corp. (IFC) and a group of nine banks agreed to lend Colombia \$130 million to complete the pipeline, which begins in Huila province before connecting with Cusiana.

Cusiana is being developed by a group led by British Petroleum.

Infraestrutura de Gas a Regiao Sul SA (Infragas), a group of 107 companies based in the Brazilian states of Parana and Catarina, may by the end of 1994 start up a 140 MMcf/d gas pipeline system in southern Brazil.

Phase 1 of the project includes building an LNG terminal in Parana or Catarina and laying a 236 mile gas grid in the two states. Cost is estimated at \$430 million.

Petroleo Brasileiro SA (Petrobras) expected to complete a 95 mile, 18 in. Osplan II products line from the Guararema tank farm to the Replan refinery in Sao Paulo in 1992.

Late in 1991 Petrobras agreed to import as much as 2.8 bcf/d from Bolivia beginning in late 1994, with supplies doubling in 2000. Brazilian and Bolivian oil officials are determining the cost and diameter of the required 900-1,050 mile pipeline.

Also, Argentina's Yacimientos Petroliferos Fiscales is studying a plan to lay a 125 mile pipeline to connect Palmar Largo oil fields to the Campo Duran refinery in Salta province near Bolivia.

If laid, the line would pass near Tonono and Santa Victoria areas where Global Resources and Cia. General de Combustibles may lay two 44 mile pipelines to transport oil to the Campo Duran refinery.

Late in 1992 the five company Chilean group, Gasnatural, disclosed plans for a \$600 million, 175 MMcf/d pipeline to transport gas from Argentina to Chile.

In Africa last year, Nigerian National Petroleum Corp. let contracts valued at \$583 million for a project that includes 1,250 miles of oil pipeline and about 3.1 million bbl of storage. Work could be complete by late in 1993.

In Zimbabwe, IFC loaned \$32 million to Petrozim Line (PVL) Ltd. to complete a \$46.7 million, 125 mile products pipeline from Feruka to Harare. The line will extend an existing system from the port of Beira, Mozambique, to Feruka.

Petrozim is a joint venture of Zimbabwe National Oil Co. and Lonhro plc.

In Japan, 32 gas, power, and trading companies agreed to build a \$23.6 billion, 2,000 mile gas pipeline system linking Sakhalin Island in the Russian Far East to the southern tip of Japan's Island of Kyushu. The system could be supplying fuel to Japan by 2005.

Early plans have the pipeline crossing La Perouse Strait from Sakhalin to the Island of Hokkaido, running down the Pacific side of the main Japanese Island, Honshu, crossing the Inland Sea to Kyushu, and terminating in the southern city of Kagoshima.

Thai Petroleum Pipeline Co. Ltd. (TPPC) in late 1991 let \$12 million contract to John Brown Engineers & Constructors Ltd. to engineer and procure components for a 145 mile products pipeline from Sriracha to Saraburi.

TPPC is a joint venture of Petroleum Authority of Thailand, Bangkok Aviation Fuel Service, and units of BP, Caltex, Exxon Corp., Kuwait National Petroleum Corp., Mobil Oil Corp., and Royal Dutch/Shell Group.

By 1993, TPPC also plans to lay a 145 mile pipeline to move refined products from Sriracha to Bangkok terminals and storage sites.

Construction costs

Construction cost estimates for planned U.S. interstate gas pipelines are indicative of the cost of building a pipeline for any service anywhere in the world.

Regulated U.S. interstate gas pipeline companies report cost estimates to FERC as part of filings to gain authorization to add or replace segments of line. The latest available figures for such estimates are current through mid-1991.

For proposed U.S. gas pipeline projects in the most recent 12 month period surveyed, the average onshore cost was \$596.747/mile, a decline of more than 28% for the 12 month period immediately preceding.

For offshore projects, the most current figure was \$637.732/mile, a decline of 23.5% from the period immediately preceding.

Combined onshore and offshore projects show a cost of \$597.222/mile for this year's coverage.

Analyses of the four major categories of pipeline construction costs—material, labor, right-of-way, and miscellaneous—also can indicate trends within each group.

Right-of-way figures include the cost of obtaining right-of-way and of surveying, along with allowance for damages.

Miscellaneous generally includes engineering, supervision, contingencies, allowances for funds used during construction (afude), administration and overheads, and FERC filing fees.

For the 129 projects surveyed for the most recent period, cost per mile data for the four categories are as follows:

- Material—Onshore \$217.348/mile, offshore \$212.734/mile, combined \$217.294/mile.

- Labor—Onshore \$228.984/mile, offshore \$306.752/mile, combined \$229.890/mile.

- Right-of-way and damages—Onshore \$25.994/mile, offshore \$81/mile, combined \$25.692/mile.

- Miscellaneous—Onshore \$121.610/mile, offshore \$117.765/mile, combined \$121.565/mile.

Although generalizations are difficult to make concerning trends in construction costs, the cost per mile figures within a given diameter category indicate that the longer the pipeline, the lower the incremental cost for construction.

Nonetheless, road and river crossings and marshy or rocky terrain each strongly affects pipeline construction costs. Material and labor make up almost 75% of the cost of laying onshore pipelines and almost 81% of the cost for offshore pipelines.

Compressor station costs make up another major cost

PIPELINING

Investment in liquids pipelines

	Company and investment, \$					Total, \$	%
	A	B	C	D	E		
CRUDE PIPELINES INVESTMENT BY FIVE COMPANIES							
Land	2,224,047	814,497	292,759	1,028,888	1,230,339	5,590,530	0.31
Right-of-way	12,288,388	1,006,210	316,392	16,762,182	16,147,724	46,520,898	2.56
Line pipe	138,201,963	25,703,218	7,797,471	98,709,406	163,529,084	433,941,141	23.85
Line pipe fittings	10,642,039	982,984	1,386,293	18,837,972	30,926,806	62,776,094	3.45
Pipeline construction	204,582,562	27,837,622	10,931,879	228,925,084	259,264,943	731,542,090	40.20
Buildings	27,877,166	5,016,815	2,568,027	14,891,186	11,797,326	62,150,520	3.42
Boilers	—	—	—	—	—	—	—
Pumping equipment	25,682,665	5,556,816	2,423,767	19,946,720	48,562,327	102,172,295	5.61
Machine tools and machinery	—	—	—	33,938	—	33,938	0.00
Other station equipment	108,501,425	23,349,854	4,712,701	50,480,879	37,899,437	224,944,296	12.36
Oil tanks	20,548,837	6,062,241	5,678,530	7,158,157	28,808,759	78,256,324	4.30
Delivery facilities	—	3,974	5,489,526	1,541,785	6,767,880	13,803,165	0.76
Communications systems	1,027,990	3,308,033	77,391	12,506,265	4,565,272	21,484,951	1.18
Office furniture and equipment	3,964,980	321,665	288,444	3,872,227	834,776	9,312,082	0.51
Vehicles and other work equip.	11,593,568	1,120,571	506,689	7,259,160	450,618	20,930,606	1.15
Other property	—	1,545,484	—	—	4,746,992	6,294,476	0.35
Total	\$567,186,430	\$102,829,964	\$42,489,989	\$491,963,948	\$616,634,273	\$1,819,783,404	100.00
PRODUCT PIPELINES INVESTMENT BY FIVE COMPANIES							
Land	4,434,304	1,763,961	591,807	1,169,417	3,846,831	11,806,320	0.39
Right-of-way	29,813,107	10,842,600	18,766,972	8,891,885	6,817,610	75,132,174	2.49
Line pipe	346,176,949	67,885,854	101,419,158	87,383,834	97,996,697	700,822,492	23.23
Line pipe fittings	73,542,993	12,961,173	15,460,544	1,743,152	22,311,631	126,929,493	4.21
Pipeline construction	588,032,243	109,853,713	195,066,240	102,037,492	162,229,915	1,157,219,603	38.37
Buildings	24,617,881	4,113,837	5,035,979	11,604,925	18,099,434	63,472,056	2.10
Boilers	—	—	—	—	—	—	—
Pumping equipment	45,231,824	6,166,137	29,148,659	28,990,682	20,472,774	130,010,176	4.31
Machine tools and machinery	—	—	—	—	501,777	501,777	0.02
Other station equipment	124,807,134	21,947,881	37,269,731	25,648,655	136,753,967	346,427,368	11.49
Oil tanks	50,505,451	18,197,220	9,079,107	20,262,896	75,943,852	173,988,526	5.77
Delivery facilities	—	—	8,445,974	12,957,782	55,550,434	76,954,190	2.55
Communication systems	2,019,811	646,028	2,453,805	10,863,024	—	15,982,668	0.53
Office furniture and equipment	11,243,580	2,662,160	3,264,406	719,294	1,289,649	19,179,089	0.64
Vehicles and other work equip.	8,757,496	2,081,707	8,894,689	3,091,836	2,738,110	25,563,836	0.85
Other property	73,347,765	—	19,123,520	—	—	92,471,285	3.07
Total	\$1,382,440,838	\$268,822,271	\$484,826,361	\$318,364,874	\$895,582,881	\$3,016,307,956	100.00

Source: U.S. FERC Form 6, Annual Report of Oil Pipeline Companies, Dec. 31, 1989.

element of natural gas pipelines. Costs for new land compressor stations for the most recent period ranged from a low of \$607/hp for a 2,000 hp added compression at a station in New York to a high of \$5,158/hp for adding 1,100 hp of compression to a Massachusetts station. Cost per horsepower figures show no particular correlation with compressor station size or location.

Operating costs

Once a natural gas pipeline is laid, compressor stations constructed, and meters installed, operating costs become the next consideration.

As an aid in estimating this element, transmission expenses for U.S. interstate gas pipelines for 1988 and 1989, the most recent years for which FERC has data available have been included in an accompanying table.

Its data are based on 251,878 miles of pipeline operated and 6.4 tcf of gas sold for 1988 majors and on 254,059 miles of pipeline operated and 5.6 tcf of gas sold for 1989 majors.

- The highest component of transmission operating expenses is transmission and compression of gas by others. For majors in 1988, this component was \$3.717/mile or \$147/MMcf. For majors in 1989, this component was \$3.363/mile or \$154/MMcf.

- The second highest cost component of transmission operating expense is gas for compressor station fuel for majors in 1988 \$1.492/mile or \$59/MMcf for majors in 1989 \$1.484/mile or \$68/MMcf.

- The highest cost component of maintenance expense

covers compressor station equipment: for majors in 1988 \$866/mile or \$34/MMcf for majors in 1989 \$989/mile or \$45/MMcf.

- The second highest cost component for maintenance is maintenance of pipelines: for 1988 majors \$435/mile or \$17/MMcf for majors in 1989 \$453/mile or \$21/MMcf.

- The table shows that the highest component of transmission expenses for natural gas pipelines is the operation expense: for 1988 majors \$8.647/mile or \$342/MMcf for 1989 majors \$8.412/mile or \$384/MMcf.

- Unit maintenance expenses for 1988 majors were \$1.631/mile or \$64/MMcf for 1989 majors \$1.780/mile or \$81/MMcf.

- During 1988, major natural gas pipeline companies spent nearly \$2.2 billion for operation expenses and \$410.8 million on maintenance. Total expenditures by 1988 majors for operation and maintenance expenses reached almost \$2.589 billion.

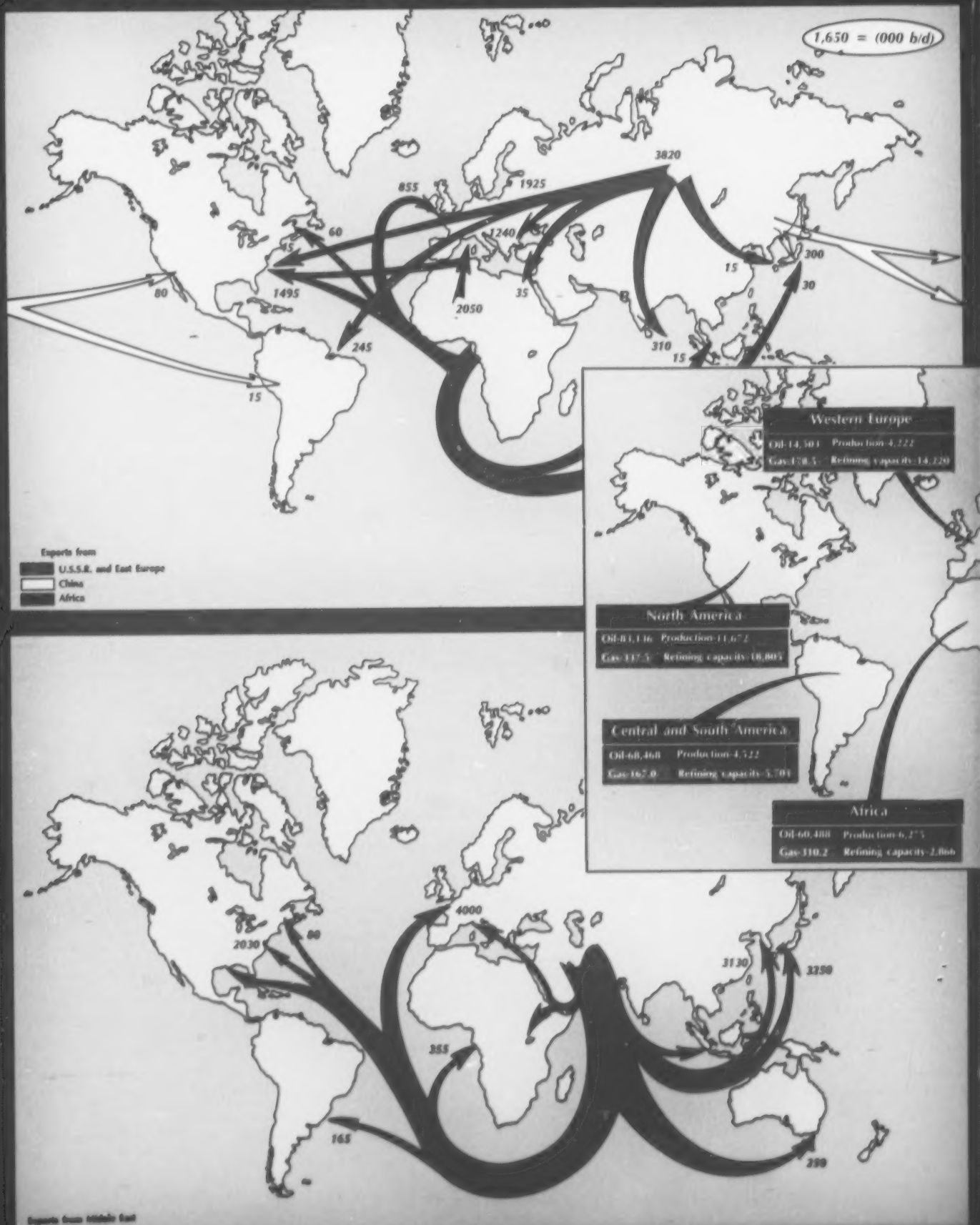
Total operation expenses for majors in 1989 fell slightly to 2.137 billion, a drop of almost \$31 million or 1.4%. This followed a small drop of 2.2% from 1987 to 1988 noted in last year's International Petroleum Encyclopedia.

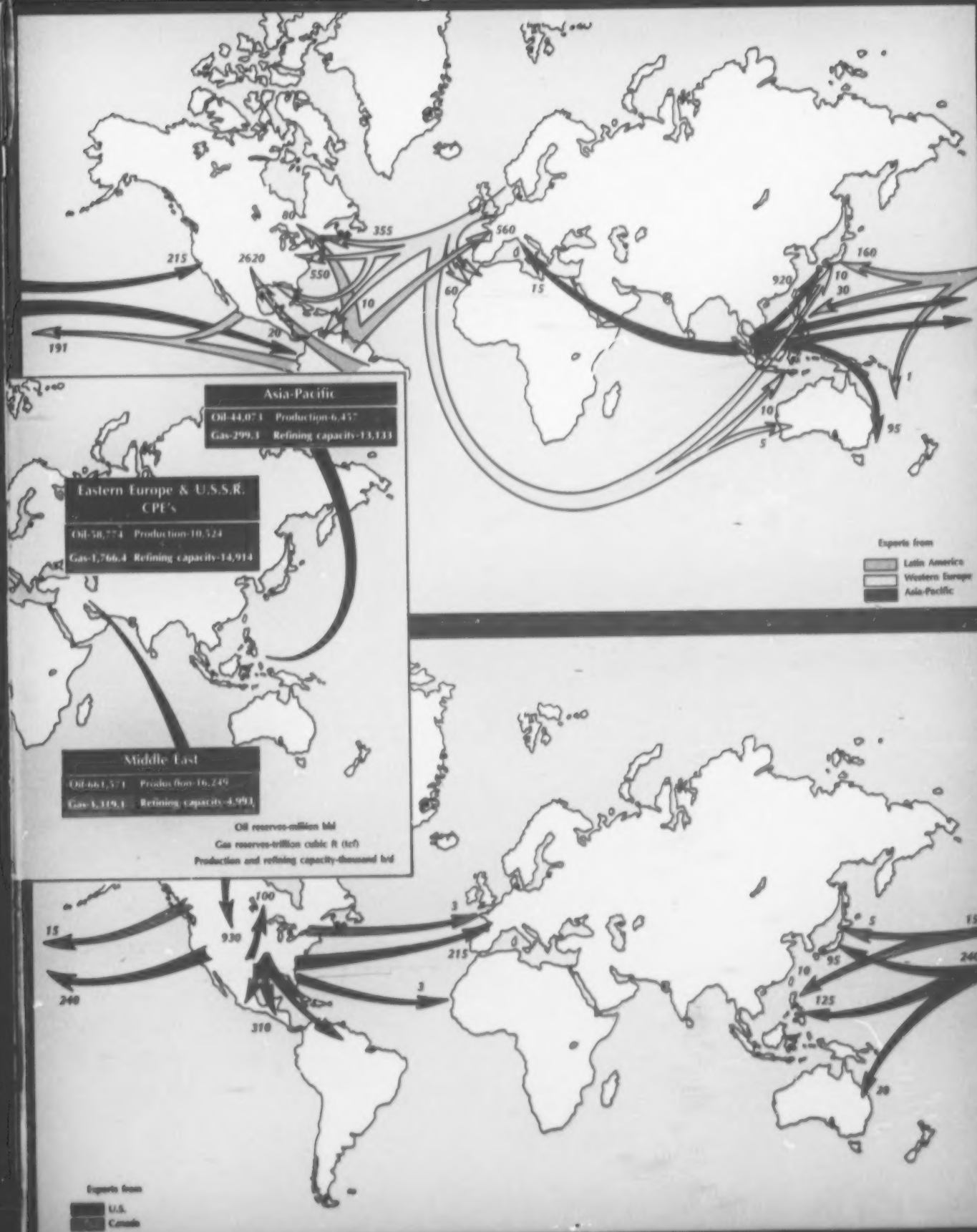
Total maintenance expenses in 1989 rose to slightly more than \$452 million from a 1988 cost of \$410.8 million.

Total transmission expenses showed a slight rise between 1988 and 1989. In the latter year, they reached \$2.589 billion.

- On a unit basis, the total 1988 transmission expense for majors was \$10.278/mile or \$407/MMcf of gas sold. For 1987 majors it was \$10.457/mile or \$402/MMcf.

World 1991: Oil Production, refining capacity, oil movements, reserves.





Refinery throughput

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	(Thousand barrels per calendar day)									
U.S.	12,470	11,775	11,685	12,045	12,005	12,715	12,855	13,445	13,550	13,595
Canada	1,780	1,520	1,455	1,460	1,430	1,395	1,460	1,535	1,555	1,595
Latin America	6,700	6,205	5,955	5,845	5,585	5,615	5,665	5,590	5,750	5,870
Western Europe	11,385	10,525	10,165	10,255	9,950	10,510	10,380	10,725	10,760	11,090
U.S.S.R. & Central Europe	12,210	12,265	12,255	12,005	11,725	11,990	12,030	12,070	11,950	11,120
Middle East	2,205	2,245	2,515	2,665	2,795	2,950	2,970	3,140	3,380	3,290
Africa	1,525	1,735	1,920	1,975	2,015	2,095	2,170	2,200	2,280	2,335
China	1,395	1,520	1,600	1,765	1,785	1,865	1,950	2,035	2,110	2,130
Japan	3,630	3,360	3,255	3,355	3,120	2,990	2,910	2,990	3,175	3,465
South Asia	795	840	880	885	1,020	1,120	1,150	1,160	1,240	1,245
Other Asia	2,510	2,365	2,410	2,485	2,685	2,800	2,785	2,915	3,115	3,320
Australasia	655	625	605	615	580	580	645	680	700	715
Total world	57,260	54,980	54,700	55,355	54,695	56,625	56,970	58,485	59,565	59,770
Of which OECD & LDCs*	43,500	41,040	40,685	41,425	41,015	42,600	42,815	44,205	45,235	46,255

*Organisation for Economic Cooperation and Development and lesser developed countries
Source: British Petroleum plc

Historical reserve data (billion bbl oil)*

	1960	1970	1975	1980	1985	1988	1989	1990	1991	1992
Asia-Pacific										
Australia	—	2.0	1.7	2.4	1.4	1.7	1.7	1.7	1.6	1.5
Brunei	—	1.0	2.0	1.7	1.4	1.4	1.4	1.4	1.4	1.4
India	—	—	—	2.5	3.5	4.3	6.4	7.5	7.9	6.1
Indonesia	9.5	10.0	14.0	9.5	8.6	8.4	8.2	8.2	11.0	6.6
Malaysia	—	—	2.5	3.0	3.0	2.9	2.9	3.0	2.9	3.0
Europe										
Norway	—	1.0	7.0	5.5	8.3	14.8	10.4	11.5	7.6	7.6
United Kingdom	—	1.0	16.0	14.8	13.6	5.2	5.2	4.2	3.8	3.9
Middle East										
Abu Dhabi	—	11.8	29.5	29.0	30.5	92.2	92.2	92.2	92.2	92.2
Divided Zone	6.0	25.7	6.4	6.0	5.4	5.2	5.2	5.2	5.0	5.0
Dubai	—	—	1.0	1.4	1.4	4.0	4.0	4.0	4.0	4.0
Iran	35.0	70.0	64.5	57.5	48.5	92.8	92.8	92.8	92.9	92.9
Iraq	27.0	32.0	34.3	30.0	44.5	100.0	100.0	100.0	100.0	100.0
Kuwait	62.0	67.1	68.0	64.9	90.0	91.9	91.9	94.5	94.5	94.0
Oman	—	—	5.0	2.3	3.5	4.0	4.0	4.2	4.3	4.3
Qatar	2.5	3.5	5.8	3.6	3.4	3.2	3.1	4.5	4.5	3.7
Saudi Arabia	50.0	128.5	148.6	165.0	169.0	166.9	169.9	254.9	257.5	257.8
Syria	1.0	1.0	1.0	1.3	1.4	1.7	1.7	1.7	1.7	1.7
Yemen	—	—	—	—	—	—	—	3.0	4.0	4.0
Africa										
Algeria	5.2	7.0	7.4	8.2	9.5	8.5	8.4	9.2	9.2	9.2
Angola-Cabinda	—	—	1.3	1.2	1.8	1.1	2.0	2.0	2.1	1.8
Egypt	—	4.5	3.9	2.9	3.2	4.3	4.3	4.5	4.5	4.5
Gabon	—	—	—	—	—	0.6	0.7	0.7	0.7	0.7
Libya	2.0	29.2	26.0	23.0	21.1	21.0	22.0	22.8	22.8	22.8
Nigeria	—	9.3	20.2	16.7	16.7	16.0	16.0	16.0	17.1	17.9
Tunisia	—	—	1.0	1.7	1.5	1.8	1.8	1.8	1.7	1.7
Western Hemisphere										
Argentina	2.2	4.5	2.5	2.5	2.3	2.3	2.3	2.3	2.3	1.6
Brazil	—	—	—	1.3	1.9	2.3	2.5	2.8	2.8	2.8
Canada	—	10.7	7.1	6.4	7.1	6.8	6.8	6.1	5.8	5.6
Colombia	—	1.7	1.7	1.0	1.624	1.6	2.0	2.0	2.0	1.9
Ecuador	—	—	2.5	1.1	1.4	1.6	1.4	1.5	1.4	1.6
Mexico	2.3	3.2	9.5	44.0	48.6	48.6	54.1	56.4	51.9	51.3
Venezuela	18.5	14.0	17.7	17.9	25.8	56.3	58.0	58.5	59.0	59.1
U.S.A.	33.5	37.0	33.0	26.4	27.3	26.3	26.5	26.9	26.2	26.3
Subtotal	288.5	311.4	355.7	382.2	414.8	408.1	423.8	417.8	416.3	432.3
U.S.S.R.	33.5	77.0	80.4	63.0	63.0	59.0	58.5	24.0	57.0	57.0
China	—	—	—	—	19.1	19.4	23.6	24.0	24.0	24.0
Other	—	—	—	—	—	1.8	1.7	1.7	1.8	1.8
Total world	382.0	511.4	688.7	848.5	898.7	887.3	887.4	1,081.6	999.1	991.0

*Columns do not add to totals because countries with lesser reserves are omitted.

Increasingly stringent environmental rules shaping refining operations

The world refining industry continued efforts in 1991 to come to grips with the ultimate effects of new environmental rules that will transform it in the 1990s.

Nowhere will that test be tougher than in the U.S., coming on the heels of passage of the Clean Air Act (CAA) amendments in late 1990.

It is ironic that 1991 ended with a milestone signaling the demise of one era in refining just as the year began by ushering in a new era. Signaling that the transition to unleaded gasoline is essentially behind the industry, Jan. 1, 1992, marked the end to sales of leaded gasoline in California.

And 1991 began with U.S. refiners trying to sort out costs, timetables, and new refinery configurations to cope with changes mandated under CAA. What became increasingly

clear during the year is that reformulated gasoline and new, low sulfur diesel is not likely to be limited to certain areas of the U.S., notably the worst air quality nonattainment metropolitan areas.

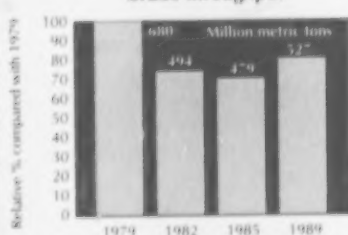
U.S. reformulated gasoline outlook

By the year 2000, it is likely that 100% of the U.S. gasoline pool will be reformulated, according to John R. Hall, chairman and chief executive officer of Ashland Oil Inc.

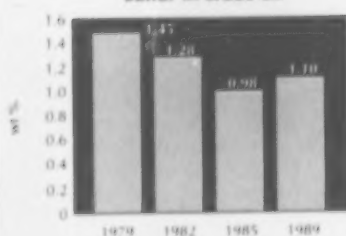
He notes that although only the nine worst U.S. ozone nonattainment areas will be required to have reformulated gasoline by 1995, CAA allows other nonattainment areas to opt into the program. Ashland projects that if all 96 ozone nonattainment areas opt in, 80% of the U.S. gasoline pool

Performance

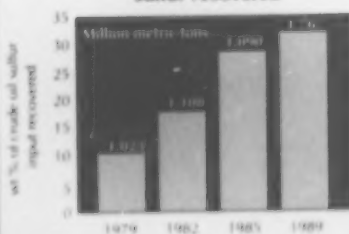
Crude throughput



Sulfur in crude oil

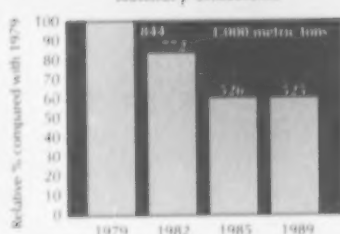


Sulfur recovered

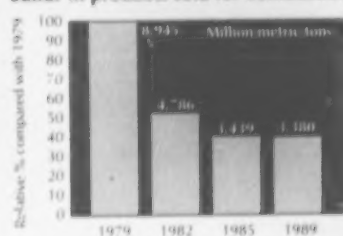


Suzanne K. Carter

Refinery emissions

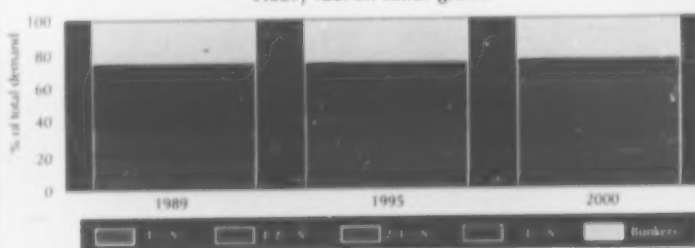


Sulfur in products sold for combustion

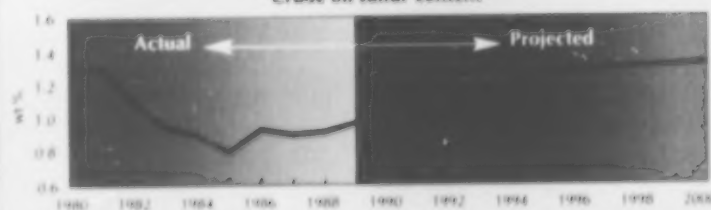


Outlook

Heavy fuel oil sulfur grades



Crude oil sulfur content †



*1 share to be restricted to less than 1% unless 1 share is over

Supplier's e-mail: C. Harvey, 9440 Avenue I, Bell

- A** Total France, isomerization \$80.78 million, fractionation and other facilities \$26.9 million
- B** Total France, isomerization \$61.04 million
- C** Mobil Oil Francaise, isomerization \$17.9 million
- D** Shell Francaise, various projects†
- E** Elf France, hydrotreating \$17.9 million
- F** Cie. Rhénane de Raffinage
- G** Elf France, catalytic reforming \$151.6 million
- H** Elf France, alkylation \$50.25 million, MTBE \$10.77 million
- I** Shell Francaise
- J** Esso S.A.F., various projects†
- K** Total France, isomerization \$71.81 million, other projects \$36.9 million
- L** BP France, isomerization, fractionation, and other projects \$143.6 million
- M** Atochem/Elf, alkylation \$143.6 million
- N** Esso S.A.F., alkylation \$107.7 million

*1985-93 †Under consideration



will have to be reformulated.

"When demand for reformulated gasoline becomes high enough, the total pool may be reformulated due to the prohibitive cost involved in maintaining three grades of both reformulated and conventional gasoline," Hall said.

"There will of course be a major cost associated with this new gasoline."

Ashland estimates that cost at 10-15¢/gal, working out to about \$9-13 billion in additional costs to consumer.

Although the exact composition of that reformulated gasoline won't be known until the U.S. Environmental Protection Agency completes a complex model required under the so-called neg-reg. or negotiated rulemaking, it is a virtual certainty gasoline will be required to have an

World MTBE capacity growth outlook

	1989	1990	1991	1992	1993	1994	1995
	b/d						
U.S.	91,800	127,350	146,950	210,450	328,100	339,100	339,100
Asia/Mideast	21,238	24,508	26,508	52,098	77,438	131,488	131,488
Western Europe	52,610	63,040	63,040	70,770	82,520	94,270	94,270
Eastern Europe	6,930	6,930	6,930	6,330	16,530	40,030	56,780
Canada/S. America	2,800	3,740	15,490	33,990	41,990	53,740	53,740
Total world	175,378	225,568	268,918	378,638	548,678	658,628	677,378

Source: DeWitt & Co.

Asia-Pacific refining capacity outlook*

	1-1-91	1-1-96	% change
	1,000 b/d		
Crude distillation	10,136	12,117	20
Reforming	1,241	1,502	21
Thermal cracking/ visbreaking	388	394	2
Hydrocracking	316	498	59
Catalytic cracking	1,022	1,415	38

*Australia, India, Indonesia, Japan, Malaysia, New Zealand, Philippines, Singapore, South Korea, Taiwan, and Thailand.

Source: Shell International Eastern Trading Co.

Table 1

Planned Japanese refining expansions

Company	Location	Capacity	
		Existing 1,000 b/d	Planned increase
Tonen Corp.	Kawasaki	190	20
Kyodo Oil CL	Kashima	150	20
Fuji Oil CL	Sodegaura	126	20
Shonwa Shell	Yokkaichi	235	60
General Sekiyu	Sakai	148	10
Nissei Sekiyu	Nishihara	54	50
Nippon Petroleum			
Refining CL	Nagishi	306	65
Koa Oil	Marifu	176	25
Nihonkai	Toyama	44	14

Table 3

Table 5

Refining conversion capacity changes

In the U.S.

Process	Capacity 1,000 b/d			Construction, 1,000 b/d		
	As of 1-1-92	As of 1-1-91	% change from 1-1-91	Vol. chg. from 1-1-91	1992 Completion* Est. % chg by 1-1-93	1993 Completion* Est. % chg by 1-1-94
Crude, b/d	15,326.6	15,478.9	-1.0	-152.3	126.0	0.82
Feed, b/d						
Thermal operations	2,016.1	2,016.9	0.1	1.2	42.5	2.1
Cat. reforming	3,936.6	3,901.5	1.0	37.1	94.0	2.4
Cat. cracking	5,504.3	5,444.4	1.1	59.9	137.0	2.5
Cat. Hydrocracking	1,315.3	1,290.8	4.3	54.5	69.0	5.2
Hydrorefining	2,436.6	2,446.9	-0.4	-10.3	2.7	0.1
Hydrotreating	7,546.0	7,270.1	1.1	77.9	146.0	2.0
Products, b/d						
Alkylation	1,096.1	1,072.4	2.2	23.7	4.0	0.4
Aromatics/teom.	647.6	636.3	1.4	11.5	20.0	2.4
Lubes	216.6	224.7	-3.6	-8.1	2.3	1.1
Coke, 1,000 tons/d	77.2	77.5	-0.4	-0.3	0.6	1.0
Asphalt	769.8	746.7	2.8	21.1	0.0	0.0

*Based on reported projects known to date.

In the EEC

Process	Capacity 1,000 b/d			Construction, 1,000 b/d		
	As of 1-1-92	As of 1-1-91	% change from 1-1-91	Vol. chg. from 1-1-91	1992 Completion* Est. % chg by 1-1-93	1993 Completion* Est. % chg by 1-1-94
Crude, b/d	12,192.7	12,184.1	0.1	6.6	94.5	0.78
Feed, b/d						
Thermal operations	1,673.6	1,613.5	3.7	60.1	3.6	0.2
Cat. reforming	1,916.1	1,900.2	0.9	17.9	149.5	7.8
Cat. cracking	1,624.6	1,600.5	1.3	24.1	71.7	3.9
Cat. Hydrocracking	414.8	399.9	3.7	14.9	56.8	13.7
Hydrorefining	1,741.5	1,732.6	0.5	8.9	12.0	0.7
Hydrotreating	4,082.0	3,894.4	4.8	187.6	140.6	3.4
Products, b/d						
Alkylation	162.0	171.3	6.3	10.7	17.0	9.3
Aromatics/teom.	379.5	341.4	11.1	38.1	49.2	13.0
Lubes	136.0	132.7	2.5	3.3	3.8	2.8
Coke, 1,000 tons/d	8.2	8.3	-0.4	-0.0	0.0	0.0
Asphalt	357.4	391.1	-8.6	-33.7	13.7	3.8

*Based on reported projects known to date.

Europe includes Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain and United Kingdom.

In the Asia-Pacific region

Process	Capacity 1,000 b/d			Construction, 1,000 b/d		
	As of 1-1-92	As of 1-1-91	% change from 1-1-91	Vol. chg. from 1-1-91	1992 Completion* Est. % chg by 1-1-93	1993 Completion* Est. % chg by 1-1-94
Crude, b/d	13,185.0	12,803.0	4.7	592.0	447.5	3.39
Feed, b/d						
Thermal operations	518.4	505.7	-6.3	-47.2	13.0	2.6
Cat. reforming	1,273.3	1,168.8	8.9	104.5	168.0	14.6
Cat. cracking	1,095.0	1,090.3	3.3	34.7	175.2	16.0
Cat. Hydrocracking	398.7	354.7	12.4	44.0	89.2	22.4
Hydrorefining	1,867.0	1,867.3	13.2	219.7	12.0	0.6
Hydrotreating	3,171.5	3,354.8	-5.5	-183.3	230.4	7.3
Products, b/d						
Alkylation	65.8	79.3	8.2	6.5	16.6	18.4
Aromatics/teom.	213.1	135.1	57.7	78.0	24.7	11.6
Lubes	105.9	112.5	-5.0	-5.6	5.8	5.4
Coke, 1,000 tons/d	3.6	3.6	-5.3	-0.2	0.0	0.0
Asphalt	173.1	211.1	-18.0	-38.0	17.7	10.2

*Based on reported projects known to date.

Asia-Pacific includes Australia, Bangladesh, Brunei, China, India, Indonesia, Japan, Korea, Malaysia, Myanmar, New Zealand, Pakistan, Philippines, Singapore, Taiwan and Thailand.

oxygen content of at least 2%, reduced levels of benzene and aromatics, a likely decrease in sulfur content, and some lowering in the 90% distillation temperature. Hall contends.

The biggest question remains whether there will be adequate supplies of oxygenates to meet the needs of U.S. industry in the years to come (Table 1). The most likely oxygenate candidates are methyl tertiary butyl ether and tertiary amyl methyl ether, especially MTBE, with ethanol contributing part of the swing supply. Ashland predicts the U.S. supply of oxygenates will meet only about two thirds of expected demand. Whether there will sufficient imports to take up the slack is uncertain; it's more likely the timetable for CAA compliance will have to be extended, or the government risks the scenario of gasoline supply shortfalls and attendant price spikes.

W. European refiners' environmental spending

In western Europe, environmental concerns will dominate refiners' agenda as well.

Tightening rules are likely to mean an end to high sulfur heavy fuel oil in western Europe's inland markets by 2000.

The outlook for bunker fuels is less clear, but the likelihood is that the maximum sulfur content for bunkers could be cut to 1.5-2%, according to a study by Chem Systems Ltd., London.

That scenario poses a dilemma for European refiners who must cope with a crude slate that features an increasingly higher average sulfur content. Chem Systems contends the resulting surplus of high sulfur residue streams, as much as 15 million metric tons/year by 2000, could force western European refiners to spend as much as \$10 billion (Fig. 1).

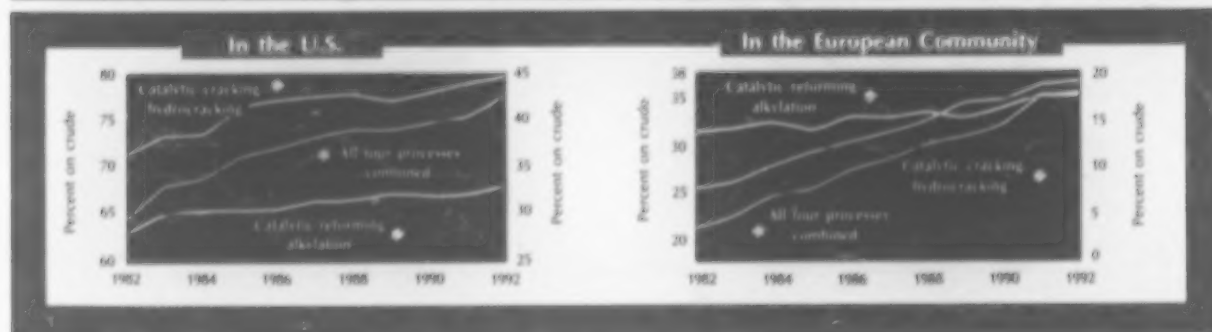
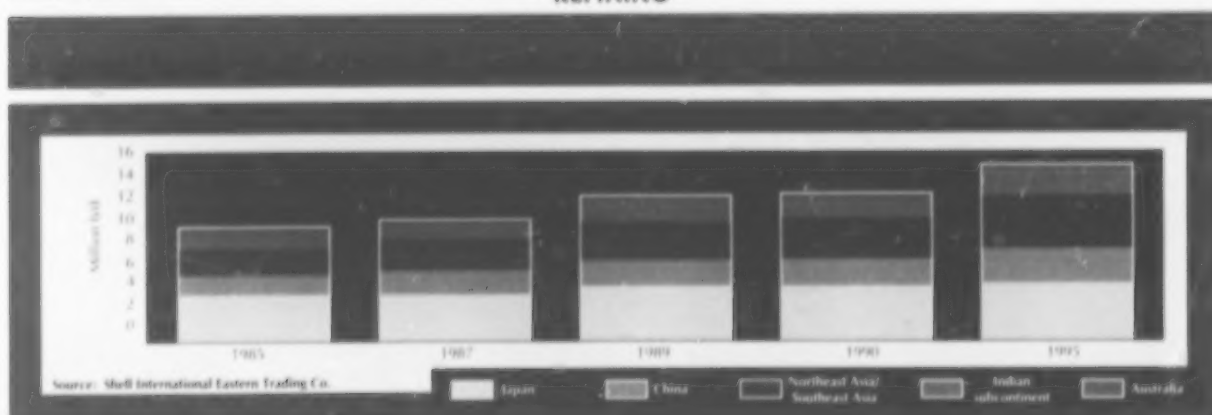
That's beyond what Western European refiners have already accomplished in handling growing levels of sulfur in residue streams and in reducing emissions. Concawe, the European oil industry's organization

Table 4

Worldwide refining by region, 1-1-92

Region	No. of Ref.	Crude b/d	Vacuum distillation b/d	Catalytic cracking b/d	Catalytic reforming b/d	Catalytic hydrocracking b/d	Catalytic hydrotreating b/d	Coke b/d
Asia-Pacific	120	13,185,035	3,127,605	1,094,995	1,273,253	398,680	1,866,980	3,600
Western Europe	116	14,230,408	5,210,316	2,002,654	2,211,193	486,640	1,901,840	6,889
Eastern Europe & U.S.S.R.	81	14,511,636	786,985	225,310	263,954	26,634	214,730	2,877
Middle East	39	4,892,894	1,541,085	254,041	527,486	489,080	489,207	2,430
Africa	44	2,886,103	378,402	172,709	329,967	36,200	122,000	941
North America	228	16,805,606	8,450,180*	5,149,970*	4,487,470*	1,514,840*	2,788,100*	78,307
South America/Caribbean	75	5,580,675	2,577,327	295,635	340,700	139,500	344,800	1,000
Total all Regions	796	74,872,888	28,693,889	10,815,395	8,444,843	2,916,874	7,778,667	87,146

*U.S. data in tons.



for environmental health and protection, estimates sulfur in products sold for combustion from 83 refineries that account for most of western European crude oil throughput fell by 62% during 1979-89. Comparable declines were seen in refinery sulfur emissions, while sales of elemental sulfur to the chemical industry about tripled in the period (Fig. 1).

Perhaps nowhere in western Europe are environmental spending plans more ambitious than in France. French refiners face especially tough challenges to meet tightening gasoline and diesel specifications and increased environmental pressures. During 1985-93, French refiners will have spent almost 6 billion francs (\$1.077 billion) just to meet a rapidly growing demand for unleaded gasoline (Fig. 2).

At least that much more will have to be spent in 1993-96 to supply more middle distillates with reduced sulfur content to meet more stringent quality requirements from the European Community.

All of this pales in comparison with what industry will have to spend during the 1990s and beyond to upgrade, expand, and modernize the refining sector of the formerly Communist nations of eastern Europe. Industry has yet to get a handle on the costs of cleaning up and bringing up to western standards the crumbling refining infrastructure of eastern Europe, but they are certain to be huge.

Asia-Pacific refining growth spurt

The Asia-Pacific refining will continue to be the most dynamic growth sector in world refining in the 1990s.

Especially strong growth will be seen in the booming "tiger" economies of Singapore, Malaysia, Thailand, South Korea, and Taiwan, with huge outlays planned for new distillation capacity to meet increases in overall demand for

U.S. hydroprocessing

	Capacity 1-1-82 1,000 b/d	Capacity 1-1-91 1,000 b/d	% Change
Hydrotreating			
Feed & heavy gas oil	916.8	778.8	-17.6
FCC & cycle stock pretreatment	1,048.5	1,170.5	+10.4
Mid distillate	387.5	437.3	+9.1
Other	73.6	59.3	-24.6
Hydrorefining			
Cat. reformer feed & naphtha	3,890.4	3,861.8	-0.5
Desulfurization	1,578.2	1,546.4	-1.9
Straight run distillate	1,481.0	1,400.3	-4.3
Lube oil polishing	225.3	221.2	-1.9
Naphtha olefin & aromatic saturation	156.2	150.4	-3.2

refined products as well as for refinery upgrades to meet growing demand for lighter products. Royal Dutch/Shell Group predicts addition of 2-2.5 million of refining capacity in the region (Table 2), with the biggest relative growth among the "tiger" economies (Fig. 3).

The region's yield of about 70% light products is expected to rise to 80% by 1995 to accommodate expected demand. Major increases in upgrading capacity are planned in Malaysia, South Korea.

A push by Japanese refiners to add distillation capacity will result in a slight decline in percentage of upgrading to primary distillation capacity (Table 3).

Worldwide refining capacity changes in 1991

The worldwide refining industry boosted capacity in

Table 7

Breakout of large refiners' operations

U.S. Companies

Rank	Company	No. of refineries	Crude capacity b/d		Cat. cracking b/d	Cat. reforming b/d	Hydro- cracking b/d	Hydro- refining/ hydro- treating b/d	Alkylation b/d	Coking b/d
1.	Chevron U.S.A.	11	1,488,100	1,580,500	423,000	334,800	245,500	887,100	80,400	178,800
2.	Exxon Co.	8	1,227,850	1,285,030	804,000	280,200	82,900	882,900	102,100	158,400
3.	Shell Oil Co.	7	1,098,200	1,142,000	318,500	298,000	161,500	607,300	77,000	96,000
4.	Amoco Oil Co.	6	982,000	1,007,500	418,500	278,900	120,000	578,600	99,400	61,500
5.	Mobil Oil Corp.	5	838,000	902,000	367,000	285,500	71,700	421,500	64,300	52,000
6.	BP Oil Co.	5	742,900	782,000	255,500	280,900	80,000	148,000	46,000	45,000
7.	Star Enterprise	3	615,000	690,000	280,000	142,000	90,000	283,900	61,300	22,000
8.	Marathon Oil Co.	5	585,000	608,000	211,000	190,500	24,000	181,000		
9.	Sun Refining & Marketing Co.	4	515,000	545,500	217,000	143,600	58,200	111,900	32,800	0
10.	CITGO	2	452,500	468,000	228,500	190,000	45,000	213,700	42,200	121,500
11.	ARCO	4	419,500	440,500	82,000	104,000	74,000	119,000	14,000	106,000
12.	Conoco Inc.	5	408,500	424,000	133,500	88,700	0	207,300	25,500	80,500
13.	Texasco Refining & Marketing Inc.	4	356,400	375,000	112,500	118,500	40,300	157,000	29,300	126,000
14.	Ashland Petroleum Co.	3	346,500	357,220	148,000	88,500	0	194,000	24,500	0
15.	Koch Refining Co.	2	343,500	360,000	95,000	80,500	0	117,500	16,900	70,000
16.	Phillips 66 Co.	3	305,000	331,000	155,400	68,000	0	218,600	31,100	0
17.	Pharo Refining Inc.	4	275,500	291,700	139,000	48,500	0	98,000	14,500	0
18.	Coastal Refining and Marketing Inc.	6	274,075	288,500	102,000	78,500	10,000	84,800	12,800	17,500
19.	Unocal Corp.	2	221,100	232,400	47,000	65,000	61,900	84,500	10,000	49,900
Total		88	11,470,425	12,108,388	4,338,400	3,024,400	1,184,800	4,816,688	684,600	1,366,400

*Excludes pretreating cat. reformer feed, naphtha desulfurization, and naphtha, diesel, or aromatics saturation.
†Includes fluid and delayed coking.

European Companies

Rank	Company	No. of refineries	Crude capacity b/d	Cat. cracking b/d	Cat. reforming b/d	Hydro- cracking b/d	Hydro- refining/ hydro- treating b/d	Alkylation b/d	Coking b/d
1.	Royal Dutch/Shell	8	1,306,000	210,000	290,000	63,000	300,300	15,100	0
2.	ESSO Corp.	8	1,184,000	180,400	190,300	0	560,800	23,200	19,900
3.	Agip Petroli	8	1,033,000	180,300	118,550	0	228,300	23,800	45,000
4.	Total Cie. Frac. des Petroles	5	787,000	104,780	124,200	31,000	198,200	2,400	0
5.	Repsol Petroleo SA	4	570,000	58,000	81,000	15,000	0	0	29,500
6.	British Petroleum Corp.	6	486,130	68,000	73,980	48,440	72,640	4,200	0
7.	EF Aquitaine	4	464,000	110,000	57,000	0	112,200	7,900	0
8.	Motor Oil (Hellas) Corinth Refineries SA	1	460,000	50,000	58,000	0	119,000	7,250	0
9.	Petrolina SA	3	349,500	76,500	59,200	0	80,800	6,150	0
10.	Eni SA	1	302,400	76,500	57,800	0	121,830	0	0
11.	Petrogal	3	284,300	10,100	51,000	9,400	38,800	0	0
12.	Cie. Espanola de Petroleos	2	290,000	36,000	48,000	0	58,000	0	0
13.	Sasol Spa	1	285,000	72,000	41,500	0	75,500	6,800	0
14.	Mobil Oil Corp.	3	250,000	47,800	41,500	0	69,300	2,200	0
15.	Petronor SA	1	240,000	40,000	35,500	0	75,000	0	0
16.	Kuwait Petroleum Corp.	2	234,000	0	46,500	48,000	71,300	0	0
17.	PCK Schwedt AG	1	230,000	37,000	41,000	0	95,160	5,500	0
18.	Irish Refining Petroleum Corp. Ltd.	1	220,000	0	34,500	59,000	86,000	0	0
19.	Ruhr Oel GmbH	1	215,400	0	38,900	30,000	63,000	0	28,000
20.	Sasol	1	210,000	18,000	27,000	0	43,000	0	0
21.	Esso Refinery Ltd.	1	200,000	66,000	25,800	0	39,600	3,700	0
TOTAL		88	9,830,730	1,431,380	1,486,510	200,840	2,486,130	108,280	122,400

*Excludes pretreating cat. reformer feed, naphtha desulfurization, and naphtha, diesel, or aromatics saturation.

†Includes fluid and delayed coking.

European countries include Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain and United Kingdom.

most key downstream processing categories in 1991.

However, distillation capacity remained basically flat at just under 75 million b/d during the year (Table 4).

Again, the Asia-Pacific sector's increase in crude capacity was offset by a slight decline in the U.S. and a negligible rise in the European Economic Community (EEC) (Table 5).

Because of its automobile dominated transportation system, the U.S. still has the world's biggest and most complex refining industry. The U.S. ratio of capacity of key downstream gasoline producing and conversion units to crude distillation capacity is more than twice that of the EEC. That comparison also holds with the Asia-Pacific sector.

However, the U.S. edge is slipping, as both sectors implement massive downstream conversion and octane capacity programs.

U.S. refining capacity changes

In the U.S., refineries continued a trend of increased

processing capability in 1991.

U.S. distillation capacity of 15.3 million b/d as of Jan. 1, 1992, represents the lowest level since 1987. The peak was in 1980 at 18.5 million b/d.

Although the U.S. refining sector registered slight decreases in crude and vacuum distillation capacities—due essentially to the closure of two refineries—there were sizable increases in conversion capacity in 1991.

The biggest gains were:

- Valero hiked its catalytic reforming and catalytic hydrocracking capacities at its Corpus Christi, Tex., refinery.

- Star Enterprise—the 50-50 joint venture of Saudi Aramco and Texaco Inc.—jumped capacities of cat cracking and hydrocracking at its Port Arthur, Tex., plant.

- Chevron increased capacity of cat hydrocracking at its Richmond, Calif., refinery.

Aside from the declines in crude and vacuum distillation capacities, U.S. refiners also logged slight declines in capacities of catalytic hydrorefining, lubes, and coking.

A key trend is the emphasis on heavier materials in U.S. primary hydroprocessing capacity increases (Table 6).

Among big refiners in the U.S., the most noteworthy change was the big increase in capacity for Citgo Petroleum Corp., courtesy of its acquisition of Champlin Refining & Chemicals Inc.'s 130,000 b/d refinery at Corpus Christi (Table 7). And the proportion of U.S. crude distillation capacity held by big refiners continued its decline in 1991 (Table 8).

Other capacity changes in 1991

EEC refiners continued their momentum of recent years toward increased processing capability.

However, growth of cracking capacities in western Europe has outpaced that of octane-related capacities the past 10 years. Big refiners hold 60% of the crude distillation capacity in the EEC, or 65 out of a total 108 refineries.

A noteworthy change to the EEC list of big refiners is the addition of a former east German refinery, PCK Schwedt, by virtue of its purchase of a European group led by Veba Oel.

In the Asia Pacific region, refiners in 1991 increased capacities for all major processes, except for coke, lubes, and asphalt.

Refinery shutdowns

The marginal increase in world crude distillation capacity in 1991 came despite some significant refinery shutdowns.

Chevron U.S.A. Inc. closed its 22,000 b/d Kenai, Alaska, refinery, citing marginal profits and the cost of compliance with Alaska's new requirement for Cook Inlet refiners preparing an oil spill response preparedness program. The Kenai plant was dismantled in June 1991.

Table 8

Big refiners' U.S. market share

	Companies with 200,000+ b/d crude capacity		Companies with less than 200,000 b/d crude capacity	
	1-1-92	1-1-91	1-1-92	1-1-91
No. Companies	19	19	89	92
No. Refineries	89	88	101	106
Crude Capacity, b/d	11,470,425	11,692,275	3,478,181	3,786,674
Crude Capacity, b/d	12,108,350	12,295,520	3,678,860	4,008,434
% U.S. capacity (b/d basis)	76.7	75.5	23.3	24.5
Cat. cracking (FF), b/d	4,338,400	4,299,900	1,005,900	1,144,500
% on crude	35.8	35.0	27.3	28.6
Cat. Reforming, b/d	3,024,400	3,063,000	747,370	818,520
% on crude	25.0	25.1	20.3	20.4
Hydrocracking, b/d	1,164,600	1,134,600	147,500	126,190
% on crude	9.6	9.2	4.0	3.1
Hydrotreating & hydro- treating, b/d*	4,815,650	4,797,150	641,400	817,650
% on crude	39.8	39.0	17.4	20.4
Alkylation, b/d	864,600	835,700	204,040	240,000
% on crude	7.1	6.8	5.5	6.0
Coking, b/d†	1,368,400	1,376,200	210,300	239,100
% on crude	11.3	11.2	5.7	6.0

*Excludes pretreating cat. reformer feed, naphtha, desulfurization and naphtha, cefin or aromatics saturation.
†Includes fluid and delayed coking.

Amoco Oil Co. closed its Casper, Wyo., refinery, citing the high costs of complying with U.S. environmental costs.

Late in the year, Farmland decided to shut down its 27,500 b/d Phillipsburg, Kan., refinery because of unprofitability of asphalt sales and the costs associated with needed environmental improvements. The closure is slated for Apr. 30, 1992.

Expected to add to the list of closures at least in part is a



Control room at Gulf Oil Refining Ltd.'s Milford Haven, Wales, refinery was redesigned by Crabtree Hall Projects Ltd., London, to improve efficiency and productivity. More such projects are likely in the 1990s as refiners try to stay profitable while coping with changing product trends and tougher environmental rules.

Table 9

Worldwide oxygenates capacity

Country	Company	Location	MTBE	TAME
United States	Amerada Hess Corp.	Port Reading, N.J.	1,200	
United States	Amoco Oil Co.	Whiting, Ind.	4,000	
United States	Amoco Oil Co.	Yorktown, Va.	800	
United States	ARCO	Channelview, Tex.	30,000	
United States	Ashland Petroleum Co.	Cattlettsburg, Ky.	3,200	
United States	Atlantic Richfield Co.	Carson, Calif.	2,400	
United States	Chevron U.S.A. Inc.	El Segundo, Calif.	2,300	
United States	Citgo Petroleum Corp.	Lake Charles, La.	2,100	
United States	Citgo Petroleum Corp.	Corpus Christi, Tex.	1,900	
United States	Coastal Refining & Marketing Inc.	Corpus Christi, Tex.	12,000	
United States	Conoco Inc.	Ponca City, Okla.	500	
United States	Crown Central Petroleum Corp.	Houston, Tex.	5,000	
United States	Diamond Shamrock Refining & Marketing Co.	Sunray, Tex.	1,810	
United States	Exxon Chemical	Baytown, Tex.	3,000	
United States	Lyondell Petrochemical Co.	Houston, Tex.	2,100	
United States	Marathon Oil Co.	Robinson, Ill.	1,450	250
United States	Marathon Oil Co.	Detroit, Mich.	1,100	
United States	Mobil Oil Corp.	Beaumont, Tex.	2,200	
United States	Phibro Refining Inc.	Houston, Tex.	1,300	
United States	Phillips 66 Co.	Sweeny, Tex.	3,000	
United States	Sun Refining & Marketing Co.	Marcus Hooks, Pa.	2,600	
United States	Texas Petrochemical Corp.	Houston, Tex.	9,800	
United States	Valero Refining Co.	Corpus Christi, Tex.	1,900	
Total			95,460	250
Country	Company	Location	MTBE	TAME
Austria	OMV Aktiengesellschaft	Schwechat	1,300	
Belgium	Fine Raffinaderij Antwerpen	Antwerp	4,500	
Brazil	Copene	Camacari, Bahia	1,400	
Czechoslovakia	Kaucuk sp.	Kralupy	2,000	
France	Arco Chemical	Fos-sur-Mer	14,500	
Germany	DEA Aktiengesellschaft	Heide	280	
Germany	Leuna-Werke AG	Leuna	2,150	
Greece	Hellenic Aspropyrgos Refinery SA	Aspropyrgos	1,600	
Italy	Agip Raffinazione Spa	Sannazzaro (Pavia)	920	
Italy	Raffineria Mediterranea Spa	Milazzo	1,400	
Italy	Prasol	Gela	1,100	
Italy	Prasol	Priolo	1,050	
Netherlands	Arco Chemie Nederland Ltd.	Rotterdam	11,900	
Netherlands	DSM - Methanor VoF	South Limburg	2,750	
Netherlands	Shell Nederland chemie BV	Pernis	2,550	
Poland	Masovian Refinery & Petrochemical Works	Plock	1,600	
Spain	Cia Espanola de Petroles	San Roque (Cadiz)	1,125	
United Kingdom	Lindsey Oil Refinery Ltd.	Killingholm, South Humberside	2,400	1,300
Venezuela	Super Octanos	Jose, Edo. Anzoategui	10,200	
Total			65,725	1,300

the top of the list is a 350,000 b/d refinery at Hui'an, Fujian province, planned for completion in 1994. Sinochem also was to complete construction by yearend on a 20,000 b/d plant at Erlian, Inner Mongolia, and plans a 20,000 b/d unit at Golmud, Qinghai Tibet, for completion in mid-1995 at a cost of \$88 million.

Indonesia's state owned Pertamina is building a 125,000 b/d refinery at Balongan, West Java.

Philippine Shell Petroleum Corp. is building a 38,000 b/d refinery at Tabangao, Batangas, Philippines, due to start up in 1994.

Significant expansions also are under way in the Asia-Pacific region.

Kyung In Energy Co. Ltd. was expected to start up by yearend 1994 its new 150,000 b/d crude unit at its Inchon, South Korea refinery. It also plans to add a 20,000 b/d vacuum distillation unit in 1992.

Partly state owned Thai refiner Bangchak Petroleum Co. Ltd. is adding a 40,000 b/d crude unit, 7,000 b/d reformer, 13,800 b/d naphtha hydrodesulfurization unit, and a 3,000 b/d Merox unit.

Taiwan's state owned Chinese Petroleum Corp. is expanding crude units by 91,700 b/d at Kaohsiung, 100,000 b/d at Taini Pei, and 64,200 b/d at Tao-yuan, all scheduled for completion by mid-1993.

In Thailand, Thai Oil Co. Ltd. is expanding crude distillation capacity at its Sri Racha refinery by 100,000 b/d and adding a 23,900 b/d platformer, 32,900 b/d naphtha hydrodesulfurization unit, and a 19,000 b/d kerosine Merox unit.

All are to start up in 1992.

In South Korea, Yukong Ltd. expects to complete work in 1992 on a 63,000 b/d vacuum distillation unit, a 30,000 b/d hydrocracker, and a 30,000 b/d residuum hydrodesulfurization unit.

Other Eastern Hemisphere refinery construction

OPEC members dominate the refinery construction scene in the Eastern Hemisphere outside the Far East.

National Iranian Oil Co. is building a \$1.8 billion, 150,000 b/d refinery at Arak, Iran, that is expected to be complete by December 1992. NIOC also plans to construct a 230,000 b/d refinery at Bandar Abbas along the Strait of Hormuz. Included in the Bandar Abbas project are a 36,000 b/d platformer, 36,000 b/d naphtha hydrodesulfurization unit, and a 25,000 b/d kerosine hydrodesulfurization unit.

In Italy, Saras SpA is building a 100,000 mild hydrocracker at its Sarnaro refinery. And Agip Petroli is adding a 20,000 b/d resid hydroconversion unit at its 200,000 b/d Milazzo refinery.

In Germany, Beta Raffineriegesellschaft Wilhelmshaven GmbH was expected to have the 160,000 b/d refinery at Wilhelmshaven fully on stream at yearend 1991.

The former owner, Mobil Oil Corp., had mothballed the plant for several years. Tentative plans are to add a hydrocracker.

Western Hemisphere refinery construction plans

As befits the rapid privatization activity spreading across Latin America, that region also dominates refinery construction plans in the Western Hemisphere.

Petroleos del Peru plans to expand vacuum distillation capacity at its Iquitos, La Pampilla, and Talara refineries by a combined total of 57,000 b/d. Petroperu also is boosting FCC capacity at two of the plants and adding a 33,000 b/d visbreaker at La Pampilla. Empresa Colombiana de Petroleos has begun basic engineering work on a 75,000 b/d refinery planned for the Middle Magdalena Valley.

In Brazil, state owned Petroleos Brasileiro SA plans to add 113,000 b/d of crude capacity at its Canoas refinery and 143,000 b/d combined atmospheric and vacuum distillation capacity at its Marape refinery.

In Venezuela, Maraven SA plans to install a 60,000 b/d coker at its Cardon refinery.

Pemex is building a 50,000 b/d visbreaker at Cadereyta, Nuevo Leon, and Salina Cruz, a 40,000 b/d FCC unit at Salina Cruz, and a 30,000 b/d reformer at Tula.

In Canada, Husky Oil Operations Ltd. has a \$1.3 billion Canadian project under way at its Lloydminster, Alta., refinery. Included are a 54,000 b/d heavy oil hydrocracker and a delayed coker expected to start up in September 1992.

It all reflects a global trend by refiners to stay abreast of product trends in a world that demands cleaner, less polluting products. That trend is certain to accelerate in the 1990s.

Survey of operating refineries worldwide

(capacities of January 1, 1992)

Country	No. plants	b/cd	
		Crude	Catalytic cracking
			Catalytic reforming
Abu Dhabi	2	192,500	30,100
Algeria	4	464,700	55,600
Angola	1	32,100	1,900
Argentina	12	696,285	171,300
Australia	10	703,000	201,300
Austria	1	210,000	25,100
Bahrain	1	243,000	39,000
Bangladesh	1	31,200	1,650
Barbados	1	3,000	...
Belgium	4	602,000	108,900
Bolivia	3	45,250	14,560
Brazil	13	1,406,220	317,085
Brunei	1	10,000	...
Cameroon	1	42,000	7,000
Canada	28	1,905,050	402,670
Chile	3	142,700	34,500
Colombia	4	274,100	95,000
Congo	1	21,000	2,000
Costa Rica	1	15,000	1,200
Cyprus	1	18,600	4,300
Denmark	3	185,500	31,100
Dominican Republic	2	48,000	9,100
Ecuador	5	141,800	16,000
Egypt	8	523,153	33,540
El Salvador	1	16,300	3,000
Ethiopia	1	18,000	2,400
Finland	2	241,000	41,800
France	14	1,815,630	356,260
Gabon	1	24,000	1,400
Germany	20	2,061,800	234,250
Ghana	1	26,600	6,175
Greece	4	395,500	61,000
Guatemala	1	16,000	3,000
Honduras	1	14,000	1,800
Hungary	3	220,000	20,000
India	12	1,122,360	136,970
Indonesia	6	860,200	13,000
Iran	5	720,000	105,400
Iraq	8	318,500	43,500
Ireland	1	56,000	11,000
Israel	2	208,000	24,000
Italy	19	2,386,358	314,300
Ivory Coast	2	69,000	13,600
Jamaica	1	34,200	3,240
Japan	41	4,612,450	646,025
Jordan	1	100,000	4,250
Kenya	1	90,000	9,000
Korea	6	1,163,100	130,000
Kuwait	4	819,000	42,000
Lebanon	2	37,500	7,250
Liberia	1	15,000	2,000
Libya	3	348,400	14,182

Country	No. plants	b/cd	
		Crude	Catalytic cracking
			Catalytic reforming
Madagascar	1	16,350	2,600
Malaysia	4	209,500	30,300
Martinique	1	12,000	3,000
Mexico	8	1,574,000	243,000
Morocco	2	154,600	5,600
Myanmar	2	32,000	...
Netherlands	6	1,218,500	128,000
Netherlands Antilles	2	470,000	42,000
New Zealand	1	95,100	26,600
Nicaragua	1	16,000	3,000
Nigeria	4	433,250	82,700
Norway	3	288,000	41,000
Oman	1	80,000	16,000
Pakistan	3	120,975	4,800
Panama	1	40,000	8,000
Paraguay	1	7,500	...
Peru	6	188,820	24,600
Philippines	4	287,100	26,400
Poland	9	333,000	32,000
Portugal	3	294,300	10,100
Puerto Rico	2	123,000	13,700
Romania	10	656,500	121,260
Qatar	1	60,000	12,030
Saudi Arabia	8	1,862,500	87,541
Senegal	1	24,000	2,600
Sierra Leone	1	10,000	...
Singapore	5	893,000	63,600
Somalia	1	10,000	...
South Africa	4	430,500	84,400
Spain	10	1,321,000	157,300
Sri Lanka	1	50,000	3,750
Sudan	1	21,700	1,900
Sweden	5	434,500	28,500
Switzerland	2	132,000	26,000
Syria	2	237,394	31,352
Taiwan	2	542,500	45,200
Tanzania	1	17,000	2,500
Thailand	3	220,550	26,100
Trinidad	2	246,000	26,000
Tunisia	1	34,000	3,300
Turkey	5	703,580	41,644
United Kingdom	15	1,856,140	454,500
United States	192	15,326,556	5,504,300
Uruguay	1	28,500	4,750
Venezuela	6	1,171,000	220,700
Virgin Islands	1	545,000	125,000
Yemen	2	114,500	10,100
Yugoslavia	7	609,135	52,050
Zaire	1	17,000	3,500
Zambia	1	23,750	5,320
Total	632	58,357,356	10,815,305



U.S. refineries, like Conoco Inc.'s 159,500 b/cd plant at Lake Charles, La., face strong demand for gasoline, diesel fuel, and other high quality products. (Photo by K. Childress, courtesy Conoco).

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
ABU DHABI			
Abu Dhabi National Oil Co.—Ruweis.....	120,000	.....	² 19,200
Umm Al-Nar 2	72,500	.....	⁴ 10,900
Total	192,500	.....	30,100

ALBANIA

Government-owned refineries at Balish, Cerrik, Stalin.

Total	40,000		
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ALGERIA

Sonatrach: Arzew	60,000		8,600
Hassi Messaoud	23,700		2,000
Marson Carree	58,000		15,000
Skikda	323,000	.....	30,000
Total	464,700	.....	55,600

ANGOLA

Fina Petroleos De Angola—Luanda	32,100	.....	¹ 1,900
Total	32,100	.....	1,900

ARGENTINA

Destileria Argentina de Petróleo			
SA—Lomas de Zamora	3,585	.....	.....
Esso SAPA—Campana ¹	93,000	¹ 29,600	² 8,300
Galvan	18,400	.....	.....
Isaura SA—Bahia Blanca	12,000	.....	.....
Shell Cia. Argentina de Petróleo			
SA—Buenos Aires	121,700	¹ 29,200	¹ 12,000
Sol Petroleo SA—San Francisco			
Solana, Quilmes	6,000	.....	.....
Yacimientos Petroliferos			
Fiscales—Campo Duran	32,000	.....	.....
Dock Sud	4,000	.....	.....
La Plata	216,000	¹ 71,900	¹ 9,000
Lujan de Cuyo	129,000	¹ 40,600	¹ 9,000
Plaza Huincul	23,000	.....	¹ 3,000
San Lorenzo	37,600	.....	.....

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
Total	596,285	171,300	41,300
Solvent Extract: ¹ 3,600 b/cd			

AUSTRALIA

Ampol Refineries Ltd.—Lyttton	74,000	¹ 28,000	⁴ 19,000
Australian Lubricating Oil Refinery Ltd.—Kurnell ¹ .....	.....	.....	.....
BP Australia—Brisbane	57,000	¹ 17,300	² 12,200
Kwinana	118,000	¹ 28,000	² 14,000
Caltex Refining CPL—Kurnell	105,000	¹ 44,000	² 27,000
Mobil Oil Australia Ltd.—Adelaide .....	.....	.....	.....
Petroleum Refineries Australia PL— Adelaide	65,500	.....	² 22,000
Altona	98,500	² 24,000	² 28,000
Shell Refining (Australia) PL—Clyde	75,000	¹ 35,000	² 13,700
Geelong	110,000	¹ 25,000	² 11,000
Total	763,000	291,300	166,900

Solvent Extract: ¹6,500 b/cd

AUSTRIA

OelMV—Schwechat	210,000	¹ 25,100 ² 7,045	² 15,600
Total	210,000	25,100	33,700

BAHRAIN

Bahrain Petroleum Co. BSC (Closed)—Sitra	243,000	¹ 39,000	² 18,000
Total	243,000	39,000	18,000

BANGLADESH

Eastern Refinery Ltd.—Chittagong	31,200		¹ 1,650
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BARBADOS

Mobil Oil Barbados Ltd.—Bridgetown	3,000		
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REFINING SURVEY

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
BELGIUM			
Belgian Refining Corp. NV—Antwerp	80,000	....	¹ 11,600
Esso Belgium—Antwerp	239,000	¹ 32,400	¹ 39,200
Nynas Petroleum NV—Antwerp	15,000	....	....
Fina Raffinaderij Antwerpen— Antwerp	268,000	¹ 76,500	¹ 45,000
Total	602,000	108,900	95,800

BOLIVIA			
Yacimientos Petroliferos Fiscales Bolivianos—			
Cochabamba	27,250	....	² 8,160
Santa Cruz	15,000	....	² 6,400
Sucre	3,000	....	....
Total	45,250	....	14,560

BRAZIL			
Petróleo Brasileiro SA: Aracária,			
Paraná ¹	144,800	¹ 42,300	....
Betim, Minas Gerais	144,700	¹ 32,100	....
Canoas, Rio Grande do Sul	72,400	¹ 13,700	....
Capuava, São Paulo	30,200	¹ 17,300	....
Cubatão, São Paulo	155,325	¹ 50,600	¹ 10,500
Duque de Caxias, Rio de Janeiro ²	209,190	¹ 35,815	¹ 13,110
Fortaleza, Ceará	....	....	....
Manaus, Amazonas	8,500	¹ 1,900	....
Mataripe, Bahia ¹	113,525	¹ 25,000	....
Paulina, São Paulo	289,500	¹ 41,600	....
São José dos Campos, São Paulo	215,080	¹ 53,770	....
Refinaria de Petróleo Ipiranga SA—Rio Grande do Sul	13,000	¹ 3,000	....
Refinaria de Petróleo de Mangui- hos SA—Rio de Janeiro	10,000	....	....
		¹ 11,000	....
Total	1,406,220	317,685	23,610

¹Solvent extraction: 27,800 b/cd. ²30,200 b/cd. ³3,400 b/cd.

BRUNEI			
Brunei Shell Petroleum CL—Seria	10,000	....	....

BULGARIA			
Government-owned refineries at Burgas, Plevan, Ruse.			
Total	300,000		

CAMEROON			
Sonara—National Refining CL— Cape Limboh, Limbe	42,000	....	² 7,000

CANADA			
Alberta			
Canadian Turbo Inc.—			
Baizac	27,500	¹ 11,570	² 7,550
Husky Oil Operations Ltd.—			
Lloydminster	23,500	....	....
Imperial Oil Ltd.—Edmonton	164,800	¹ 47,500	² 20,500
Parkland Refining Ltd.—			
Bowden	6,650	....	² 3,000
Petro-Canada Products Inc.—			
Edmonton	115,500	¹ 33,300	² 9,000
Shell Canada Ltd.—Scottford	59,800	....	² 21,500
Total	397,750	92,370	61,550

British Columbia			
Chevron Canada Ltd.—			
North Burnaby	45,000	¹ 13,000	² 10,000
Husky Oil Operations Ltd.—			
Prince George	9,500	¹ 3,300	² 1,400
Imperial Oil Ltd.—Ioco	44,200	¹ 13,100	² 6,700
Petro-Canada Products Inc.—			
Port Moody	25,500	....	² 8,600
Taylor	15,500	¹ 6,300	² 3,000
Shell Canada Ltd.—			
Shellburn, Burnaby	24,000	¹ 6,100	² 3,600
Total	163,700	41,800	33,300

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
New Brunswick			
Irving Oil Ltd.—St. John	237,500	¹ 17,100	² 34,650
Total	237,500	17,100	34,650

Newfoundland			
Newfoundland Processing Ltd.— Come By Chance	106,000	....	² 26,000

Northwest Territories			
Imperial Oil Ltd.—Norman Wells	3,500	....	....

Nova Scotia			
Imperial Oil Ltd.—Dartmouth	84,400	¹ 24,700	¹ 10,000
Ultramar Canada Inc.—Halifax	20,000	¹ 7,200	² 3,600
Total	104,400	31,900	13,600

Ontario			
Imperial Oil Ltd.—Nanticoke	112,100	¹ 40,900	² 26,800
Sarnia	118,800	¹ 25,700	² 13,000
			¹ 14,000

Petro-Canada Products Inc.—			
Clarkson	41,500	....	² 9,800
Oakville	80,500	¹ 25,400	² 13,200
Shell Canada Ltd.—Sarnia	71,000	¹ 14,400	² 21,000
Sunoco Inc.—Sarnia	83,400	¹ 16,300	² 26,100
Total	587,300	122,700	123,900

Quebec			
Petro-Canada Products Inc.—			
Montreal	87,400	¹ 17,200	² 31,300
Shell Canada Ltd.—Montreal	120,000	¹ 22,000	² 20,700
Ultramar Canada Inc.—St. Romuald	120,000	¹ 40,000	² 17,100
Total	327,400	79,200	69,100

Saskatchewan			
Consumers' Cooperative Refineries Ltd.—Regina	45,200	¹ 17,600	² 9,000
Producers Pipeline— Moose Jaw	13,300		
Total	58,500	17,600	9,000

Total Canada	1,905,850	482,870	371,100
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CHILE			
ENAP—Gregorio Magallanes	9,000		
Petrox SA—Talcuano	71,000	¹ 17,000	² 4,200
Refinaria de Concón—Concón	62,700	¹ 17,500	² 5,000
Total	142,700	34,500	9,200

CHINA			
Government-owned refineries at Anshan, Beijing, Dalian, Daqing, Fushun, Hangzhou, Jiroi, Karamai-Dushanzi, Lanchow, Lenghu, Maoming, Nanchong, Nanjing, Shanghai, Shengli, Tianjin, Yumen.			
Total	2,200,000		

COLOMBIA			
Empresa Colombiana de Petróleos			
—Barrancabermeja-Santander ¹	196,000	¹ 66,000	² 6,000
Cartagena, Bolívar	70,700	¹ 29,000	....
Orito, Putumayo	2,400	....	....
Tibu, N. de Santander	5,000	....	....
Total	274,100	95,000	6,000

Solvent extraction: ¹37,000 b/cd.

CONGO			
Coral—Pointe-Noire	21,000	....	² 2,000

COSTA RICA			
Refinadora Costarricense de Petro- leo SA—Limón	15,000	....	² 1,200

CUBA			
Government-owned refineries at Cabaiguan, Cienfuegos, Havana, Santiago de Cuba.			
Total	200,000		

REFINING SURVEY

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
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CYPRUS

Cyprus Petroleum Refinery Ltd.— Lamaca	18,600		² 4,300
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CZECHOSLOVAKIA

Government owned refineries at Pardubice, Strazke, Zakuzy, Zvolen.
Crude Capacity

Kaucuk s.p.—Kralupy	65,000	....	² 8,000
Koramo Kolin—Kolin ²	4,750	....	....
Slovnaft s.p.—Bratislava ¹	148,000	....	² 22,500
Total	455,000	....	30,500

Solvent extraction: ¹1,000 b/cd, ²1,550 b/cd.

DENMARK

AS Dansk Shell-Fredericia	62,000	....	² 12,000
Statoli AS—Kalundborg	65,000	....	² 8,600
Kuwait Petroleum Refining (Denmark) A/S—Skalskoer	58,500	....	² 10,500
Total	185,500	31,100	....

DOMINICAN REPUBLIC

Falconbridge Dominicana C por A-La Bonao	16,000	....	....
Refineria Dominicana de Petróleo SA-Haina	32,000	....	¹ 9,100
Total	48,000	....	9,100

ECUADOR

CEPE—Esmeraldas	90,000	¹ 16,000	² 2,780
Sta. Elena Peninsula	32,300	....	....
Refineria Amazonas	10,000	....	....
Repetrol—Santa Elena	8,500	....	....
Texaco—Lago-Agrio	1,000	....	....
Total	141,800	16,000	2,780

EGYPT

Alexandria Petroleum Co.— Alexandria—(El-Mex)	97,850	....	....
Cairo Oil Refining Co.—Mostorod	156,750	....	² 9,000
Tanta	21,800	....	....
Amerya Oil Refining Co.— Alexandria	64,000	....	² 12,000
El-Nasr Petroleum Co.—El-Suez	58,400	....	....
Wadi-Feran	9,680	....	....
Suez Oil Processing Co.—El-Suez	62,530	....	² 12,540
Assiout	52,143	....	....
Total	523,153	....	33,540

EI SALVADOR

Refineria Petrolera Acajutla SA— Acajutla	16,300		¹ 3,000
Total	16,300		3,000

ETHIOPIA

Ethiopian Petroleum Corp.—Assab	18,000		² 2,400
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FINLAND

Neste Oy—Naantali	44,000	² 13,300	² 6,800
Porvoo	197,000	² 28,500	² 36,100
Total	241,000	41,800	42,900

FRANCE

CRD—Total France— Gonfreville L'Orcher ¹	309,000	¹ 31,500	² 45,400
La Média	136,000	² 29,700	² 23,400
Mardyck	122,000	² 29,800	² 20,500
Cie. Rhénane de Raffinage— Reichstett-Vendenheim	80,000	¹ 13,760	¹ 12,900
Elf France—Donges	200,000	² 66,000	² 25,600
Feyzin	120,000	² 22,700	² 8,600
Grandpuits	92,000	² 28,800	² 12,900

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
Esso SAF—Fos sur Mer	100,000	¹ 24,000	¹ 18,000
Port Jerome	136,000	¹ 24,600	¹ 16,000
Mobil Oil Française— Notre Dame de Gravenchon	57,000	....	² 13,300
Shell Française—Berre l'Etang	128,000	¹ 38,000	² 19,000
Petit Couronne	158,000	¹ 20,000	² 28,000
Sta. Française des Pétroles BP— Dunkirk	....	....	....
Lavara	177,630	¹ 28,000	¹ 5,160
Total	1,815,630	356,260	248,760

Solvent extraction: ¹9,800 b/cd.

GABON

Ste. Gabonaise de Raffinage— Port Gentil	24,000		² 1,400
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GERMANY

Addinol Mineralöl GmbH Lutzken dorf—Krumpha, Kreis Merseburg ¹	16,500		
BP Oiltech GmbH—Hamburg ²	....	....	....
DEA Mineralöl AG—Heide	80,000	¹ 9,000	² 20,000
UK-Wesseling	100,000	....	² 19,000
Deutsche Shell AG—Goderf	170,000	....	² 17,000
Harburg-Grasbrook	86,000	¹ 15,000	² 16,000
Erdoel Raffinerie Neustadt GmbH—Neustadt-Donau	144,000	² 26,000	¹ 17,700
Esso AG—Ingolstadt	95,000	¹ 24,500	² 15,600
Karlsruhe	150,000	....	² 30,900
Holborn Europa Raffinerie GmbH—Harburg	78,000	¹ 18,750	² 14,700
Hydrierwerk Zeitz GmbH—Zeitz	73,700	....	....
Leuna-Werke AG—Leuna	100,000	....	² 15,000
Mobil Oil AG—Woerth	93,000	¹ 19,000	² 15,900
DMV Deutschland GmbH—Burghausen	68,400	....	....
PCK Schwedt AG—Schwedt	230,000	¹ 37,000	² 23,000
Raffineriegesellschaft— Vohburg/Ingolstadt	120,000	¹ 19,000	² 18,000
Ruhr Öl GmbH—Gelsenkirchen	215,400	....	¹ 11,900
Wintershall AG—Lingen	65,000	....	² 27,000
Salzbergen	2,800	....	² 12,200
Total	2,061,800	234,250	379,480

Solvent extraction: ¹5,000 b/cd, ²8,400 b/cd.

Note: Some of the smaller east german refineries are not accounted for.

GHANA

Ghanaian Italian Petroleum CL—Tema	26,800		² 8,175
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GREECE

Hellenic Aspropyrgos Refinery SA—Aspropyrgos	121,000	¹ 32,200	² 9,800
Motor Oil (Hellas) Corinth Refineries SA—Aghii Theodor	100,000	² 28,800	² 20,600
Petrolia Hellas SA—Elefsis	108,000	....	....
Thessaloniki Refining Co. AE— Thessaloniki	66,500	....	² 8,100
Total	395,500	61,000	50,800

GUATEMALA

Texas Petroleum Co.—Escuintla	16,000	....	² 3,000
Total	16,000	....	3,000

HONDURAS

Refineria Texas de Honduras SA— Puerto Cortes	14,000	....	¹ 1,000
Total	14,000		1,000

HUNGARY

Dunai KV—Százhalombatta	150,000	² 20,000	² 23,000
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REFINING SURVEY

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
Tiszai KV-Leninváros	60,000	....	....
Zalai KV-Zalaegerszeg	10,000	....	....
Total	220,000	20,000	23,000

INDIA

Bharat Petroleum CL-			
Mahul, Bombay	156,600	'33,800	'5,400
Bongaiaon Refinery & Petrochemicals Ltd.-Bongaiaon, Assam	27,610	....	'1,833
Cochin Refineries Ltd.-			
Ambalamugal	90,000	'20,000	'5,000
Hindustan Petroleum CL-			
Mahul, Bombay ¹	111,650	'12,000	....
Visakhapatnam	90,000	'19,200	....
Indian Oil CL-Barauni, Bihar ²	70,200	....	....
Digboi, Assam	11,700	....	....
Guwahati, Assam	18,100	....	....
Koyali, Gujarat	205,700	'20,100	'8,300
Haldia, West Bengal ³	61,100	....	'5,300
Mathura, Uttar Pradesh	165,000	'20,100	....
Madras Refineries Ltd.-Madras	114,700	'11,770	'2,400
Total	1,122,360	136,970	28,233

Solvent extraction: ¹10,000 b/cd, ²4,000 b/cd, ³16,000 b/cd.

INDONESIA

Pertamina-Balikpapan, Kalimantan	257,500	....	'20,000
Cilacap, Central Java	302,400	....	'12,800
		....	'17,300
Dumai, Central Sumatra	122,500	....	'5,400
		....	'8,100
Musi, South Sumatra	126,950	'13,000	....
Pangkajene Brandan, North Sumatra	4,800	....	....
Sungai Pakning, Central Sumatra	46,100	....	....
Total	860,200	13,000	63,600

IRAN

National Iranian Oil Co.-			
Abadan	190,000	....	'41,555
Esfahan	200,000	....	'29,600
Shiraz	40,000	....	'6,245
Tabriz	80,000	....	....
Tehran	210,000	....	'28,000
Total	720,000	....	105,400

IRAQ

Oil Refineries Administration-Baiji	150,000	....	22,000
		....	16,500
Basra	70,000	....	....
Daura	71,000	....	5,000
K3-Haditha	7,000	....	....
Khanaqin	12,000	....	....
Muthia	4,500	....	....
Qaiyarah, Mosul	2,000	....	....
Iraqi Company for Oil Operations-Kirkuk	2,000	....	....
Total	318,500	....	43,500

Note: Present status uncertain due to lack of information.

IRELAND

Irish National Refining plc-Whitegate	56,000		'11,000
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ISRAEL

Oil Refineries Ltd.-Ashdod	88,000		'12,000
Haita	120,000	'24,000	'16,000
Total	208,000	24,000	28,000

ITALY

Agip Plas SpA-Livorno	84,000	....	'12,000
Agip Raffinazione SpA-			
Porto Marghera	80,000	....	'15,000
Rho, Milan	80,000	'14,300	'11,000
Sannazzaro, Pavia	200,000	'34,000	'12,000
		....	'16,700

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
Taranto	84,000	....	'17,000
Anonima Petroli Italiana-Falconara, Marittima	63,000	....	'11,000
Arcoia Petrolifera SpA-La Spezia	17,358	....	....
Esso Italiana SpA-			
Augusta, Siracusa	180,000	'44,000	'22,000
Industria Chimiche Italiane de Petroli SpA-Frassino, Mantova	55,000	....	'7,200
Iplom SpA-Busalla	46,500	....	....
Isab-Priolo Gargallo	220,000	....	'34,500
Kuwait Raffinazione E Chimica-Napies	100,000	'20,000	'26,000
Raffineria di Roma SpA-Rome	81,500	....	'14,200
Raffineria Mediterranea SpA-Milazzo	160,000	'45,000	'12,000
Saras SpA-Sarroch	285,000	'72,000	'27,000
Sarpom-S. Martino Di Trecate	210,000	'18,000	'19,000
		....	'8,000
Praoil-Gela	105,000	'35,000	'13,850
Priolo	240,000	'32,000	'9,000
Tamoli Italia SpA-Cremona	95,000	....	'12,400
Total	2,386,358	314,300	299,860

IVORY COAST

Ste. Ivoirienne de Raffinage-Abidjan	59,000	....	'13,600
Ste. Multinationale de Bitumes-Abidjan	10,000	....	....
Total	69,000	....	13,600

JAMAICA

Petrojam Ltd.-Kingston	34,200	....	'3,240
Total	34,200	....	3,240

JAPAN

Cosmo Oil CL-Chiba	209,000	'30,400	'34,675
Sakaido	133,000	'16,150	'13,300
Sakai	104,500	'18,525	'8,650
Yokkaichi City	166,250	'23,750	'5,700
		....	'10,450
Fuji Oil CL-Sodegaura, Chiba	146,500	'14,000	'16,300
General Sekiyu Seisei KK-Sakai	140,000	'32,500	'30,600
Idemitsu Kosan CL-Chita, Aichi	150,000	'33,000	'18,000
Himeji, Hyogo	120,000	....	'17,000
Ichihara, Chiba ²	274,000	'42,000	'17,000
Tokuyama, Yamaguchi	120,000	'24,000	....
Tomakomai, Hokkaido	114,000	....	'18,000
Kainan Petroleum Refining CL-Kaiwan City, Wakayama	64,000	....	....
Kashima Oil CL-Kashima, Ibaragi	165,000	'20,000	'7,500
		....	'14,000
Koa Oil CL-Marifu	110,000	'20,000	'20,000
Osaka	80,000	'23,500	'11,000
Kyenu Sekiyu Seisei KK-Kawasaki	66,500	....	....
Kyokuto Petroleum Ltd.-Chiba	125,000	....	'22,000
Kyushu Oil CL-Oita	130,000	'16,500	'8,000
Mitsubishi Oil CL-Kawasaki	55,000	....	'10,000
Mizushima	220,000	'34,000	'25,000
		....	'18,500
Nansei Sekiyu KK-Nishihara, Okinawa	72,000	....	'8,600
Nihonkai Oil CL-Toyama	46,000	'5,000	....
Nippon Mining CL-Chita	76,800	'13,600	'19,900
Funakawa	5,400	....	....
Mizushima ¹	172,000	'36,200	'20,800
Nippon Oil CL-Niigata	26,000	'5,000	....
Nippon Petroleum Refining CL-Muroran	150,000	'21,000	....
Nakagusuku, Okinawa	....	....	'3,000
Negishi	305,000	'39,000	'20,000
Yokohama	....	....	'4,000
Okinawa Sekiyu Seisei-Yonashiro, Okinawa	57,000	....	....
Seibu Oil CL-Yamaguchi	110,100	'19,900	'20,000
Showa Shell Sekiyu KK-Kawasaki	96,400	....	'13,800
Niigata	27,500	....	'4,300
Showa Yokkaichi Sekiyu CL-Yokkaichi	165,200	'22,600	'40,800
Taiyo Oil CL-Ehime	65,000	....	'6,000
		....	'23,000

REFINING SURVEY

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
Tonen Corp.-Kawasaki	209,000	¹ 74,100	² 18,600
Wakayama	157,700	¹ 34,200	² 34,875
Toa Oil CL-Kawasaki	59,700	¹ 27,100	² 7,100
Toho Oil CL-Owase	35,000	....	....
Tohoku Oil CL-Sendai	83,900	....	² 12,000
Total	4,612,480	646,025	632,570
Solvent extraction: ¹ 3,900 b/cd. ² 16,000 b/cd.			

JORDAN

Jordan Petroleum Refinery-Zerka	100,000	¹ 4,250	² 8,640
Total	100,000	4,250	8,640

KENYA

Kenya Petroleum Refineries Ltd.- Mombasa	90,000		¹ 3,800 ² 5,200
Total	90,000		9,000

KOREA, N.

Government-owned, Unggi	42,600		
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KOREA, S.

Honam Oil Refinery CL-Yochon	342,000		² 15,300
Kukdong Oil CL-Busan ¹	10,000		
Daesan	60,000	....	² 3,000
Kyung In Energy CL-Inchon	60,000	....	² 3,600
Ssangyong Oil Refining CL-Onsan ²	146,100	....	² 4,800
Yukong Ltd.-Ulsan	545,000	....	² 21,300 ² 55,000
Total	1,163,100	....	130,000

Solvent extraction: ¹2,100 b/d. ²8,000 b/d.

KUWAIT

Getty Oil Co. (subsidiary of Texaco Inc.)-Mina Al-Zour	72,000	....	....
Kuwait National Petroleum Co. -Mina Abdulla	190,000	....	....
Mina Al-Ahmadi	370,000	¹ 28,000	² 33,000
Shuaiba	187,000	² 14,000	....
Total	819,000	42,000	33,000

Note: Most capacity shutdown due to damage during Iraqi occupation.

LEBANON

Tripoli Oil Installations-Tripoli	20,000	¹ 7,250	² 4,392
Zahrani Oil Installations-Sidon	17,500	....	² 3,050
Total	37,500	7,250	7,442

LIBERIA

Liberia Petroleum Refining- Monrovia	15,000	....	¹ 2,000
Total	15,000	....	2,000

LIBYA

Azzawiya Oil Refining Co.-Azzawiya	120,000	....	² 12,982
Ras Lanuf Oil & Gas Processing Co.-Ras Lanuf	220,000	....	....
Sirta Oil Co.-Brega	8,400	....	¹ 1,200
Total	348,400		14,182

MADAGASCAR

Solima-Managareza, Tamatave	16,350		¹ 2,600
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MALAYSIA

Esso Malaysia Berhad- Port Dickson	47,500		² 13,300
Petronas Penapisan Sdn. Berhad -Kertoh, Kemaman, Terengganu	27,000		
Sarawak Shell Berhad-Luton	45,000	....	....
Shell Refining Co. Berhad-Port .....	....	....	....

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
Dickson	90,000	....	¹ 4,000 ² 13,000
Total	209,500	....	30,300

MARTINIQUE

Ste. Anonyme de la Raffinerie des Antilles-Fort-de-France	12,000	....	² 3,000
Total	12,000	....	3,000

MEXICO

Petroleos Mexicanos-Cadereyta	235,000	¹ 40,000	² 20,000
Ciudad Madero ¹	195,000	¹ 43,000	² 15,000
Minatitlan	200,000	² 9,000 ² 24,000 ² 16,000	² 48,000
Poza Rica	50,000	....	....
Reynosa	9,000	....	....
Salamanca	235,000	¹ 40,000	² 24,800
Salina Cruz	330,000	¹ 40,000	² 50,000
Tula, Hidalgo	320,000	¹ 40,000	² 30,000
Total	1,574,000	243,000	187,800

Solvent extraction: ¹38,000 b/cd.

MOROCCO

Samir-Mohammedia	129,000	....	² 24,000
Ste. Cherifenne des Petroles -Sidi Kacem	25,600	² 5,600	² 2,800
Total	154,600	5,600	26,800

MYANMAR

Myanma Petrochemical Enterprise- Chauk	6,000	....	....
Thantlyn	26,000	....	....
Total	32,000	....	....

Formerly Burma

NETHERLANDS

Esso Nederland BV-Rotterdam	175,000	....	² 26,600
Kuwait Petroleum Europoort BV- Rotterdam ¹	75,500	....	² 21,000
Netherlands Refining Co.- Europoort & Pernis	465,000	¹ 50,000	² 58,000
Shell Nederland Raffinaderij BV-Pernis	345,000	¹ 78,000	² 17,000 ² 42,000
Smid & Hollander Raffinaderij BV-Amsterdam	10,000	....	....
Total Raffinaderij Nederland NV- Vlissingen	150,000	....	² 22,000
Total	1,218,500	128,000	186,600

Solvent extraction: ¹3,200 b/cd.

NETHERLANDS ANTILLES

Refineria Isla Curacao SA- Emmestad	320,000	¹ 42,000	² 15,000
Coastal Aruba Refining Co. N.V.- San Nicolas	150,000	....	....
Total	470,000	42,000	15,000

NEW ZEALAND

New Zealand Refining-Whangarei ¹	95,100	....	² 26,600
Total	95,100	....	26,600

Solvent extraction: ¹10,000 b/cd.

NICARAGUA

Esso Standard Oil SA Ltd.- Managua	16,000	....	¹ 3,000
Total	16,000	....	3,000

REFINING SURVEY

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
NIGERIA			
Kaduna Refinery & Petrochemical Co. (NNPC)-Kaduna ¹	104,500	¹ 18,000	² 15,300
Port Harcourt Refining Co. (NNPC)-Alesa Eleme	60,000	.....	¹ 6,000
Rivers State	150,000	¹ 40,000	² 33,000
Warri Refinery & Petrochemical Co. (NNPC)-Warri	118,750	¹ 24,700	² 15,770
Total	433,250	82,700	70,870

Solvent extraction: ¹9,492 b/cd.
†Dimersol

NORWAY			
Esso Norge AS-Stagen-Toensberg	90,000	.....	² 10,600
Norske Shell AS-Sola	53,000	.....	² 11,000
Statoil Division Mongstad- Mongstad	145,000	² 41,000	² 10,000
			¹ 16,000
Total	288,000	41,000	47,600

OMAN			
Oman Refinery Co.-Mina Al Fahal	80,000	.....	² 16,000

PAKISTAN			
Attock Refinery Ltd.-Rawalpindi	30,500	.....	.....
National Refinery Ltd.- Korangi, Karachi ¹	44,175	.....	² 2,100
Pakistan Refinery Ltd.-Karachi	46,300	.....	² 2,700
Total	120,975	.....	4,800

¹Solvent Extraction: 5,605

PANAMA			
Refineria Panama SA-Las Minas	40,000	.....	² 8,000
Total	40,000	.....	8,000

PARAGUAY			
Petroleos Paraguayos-Villa Elisa	7,500	.....	.....

PERU			
Petróleos del Peru:			
Conchan	6,300	.....	.....
Iquitos, Loreto	10,500	.....	.....
La Pampilla, Lima	105,000	¹ 8,000	¹ 1,760
Marsella, Loreto	2,170	.....	.....
Pucallpa	2,850	.....	.....
Talara	62,000	¹ 16,600	.....
Total	188,820	24,600	1,760

PHILIPPINES			
Caltex (Philippines) Inc.-Batangas	66,300	¹ 11,400	² 5,400
Petron Corp.-Limay, Bataan	155,000	² 15,000	² 6,800
			² 17,000
Philippine Petroleum Corp.-Piliila	.....	.....	.....
Pilipinas Shell Petroleum- Tabangao	65,800	.....	¹ 8,000
Total	287,100	26,400	37,200

† Polymerization Mothballed.

POLAND			
Government-owned refineries at Czechowice, Glinik Mariampolski, Jasto, Jealicze, Kralaty, L. Warynski, Trzebinia.			
Crude capacity	73,000	.....	.....
Mazovian Refinery & Petrochemical Works-Plock	200,000	¹ 32,000	² 24,000
Petroleum Refinery Gdansk- Gdansk ¹	60,000	.....	¹ 11,000
Total	333,000	32,000	35,000

Solvent extraction: ¹6,800 b/cd.

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cat reforming
PORTUGAL			
Petrogal-Lisboa	.....	² 10,100	.....
Laça da Palmeira, Porto	88,300	.....	² 15,600
Sines	206,000	.....	² 10,500
			² 24,900
Total	294,300	10,100	51,000

PUERTO RICO			
Caribbean Petroleum Corp.- Bayamón	38,000	¹ 13,700	² 6,500
Puerto Rico Sun Oil Co.-Yabucoa	85,000	.....	² 20,000
Total	123,000	13,700	26,500

QATAR			
National Oil Distribution Co.- Umm Said	60,000	² 2,200	.....
		² 9,830	.....
Total	60,000	.....	12,030

ROMANIA			
Arpechim SA-Pitești	125,000	¹ 36,760	² 20,422
Astra SA-Pitești	38,000	.....	.....
Darmianesti Refinery	.....	.....	.....
Darmianesti	33,500	.....	.....
Petrobrazi SA-Ploesti	150,000	² 21,800	² 34,460
Petrolsub SA-Barcau	8,000	.....	.....
Petromidia SA-Midia	70,000	² 20,000	² 11,400
Petrolul SA-Ploesti	104,000	² 20,300	² 11,490
Rafu SA-Onesti	104,000	² 21,800	² 22,980
Steaua SA-Cimpina	8,000	.....	.....
Vega SA-Ploesti	16,000	.....	.....
Total	656,500	121,280	100,842

SAUDI ARABIA			
Saudi Arabian Oil Co. (Saudi Aramco)-Ras Tanura			
	530,000	.....	² 50,000
Arabian Oil CL-Ras Al Khafji	30,000	.....	.....
Jeddah Oil Refinery-Jeddah	82,000	¹ 9,041	² 2,622
Petromin-Mobil-Yanbu	300,000	¹ 78,500	² 43,300
Petromin Petrola Rabigh Refinery Co.-Rabigh	332,500	.....	.....
Petromin-Shell-Al-Jubail ¹	284,000	.....	¹ 9,000
Riyadh Oil Refinery-Riyadh ²	134,000	.....	² 28,600
			² 5,400
Yanbu Petromin Refinery-Yanbu	170,000	.....	² 35,000
Total	1,862,500	87,541	183,922

Solvent extraction: ¹14,000 b/cd. ²6,800 b/cd.

SENEGAL			
Ste. Africaine de Raffinage- M'Bao (Dakar)	24,000	.....	² 2,000

SIERRA LEONE			
Sierra Leone Petroleum Refining Co.-Freetown	10,000	.....	.....

SINGAPORE			
BP Refinery Singapore PL- Pasir Panjang	28,000	.....	.....
Esso Singapore PL-Pulau Ayer Chawan	205,000	.....	² 11,400
Mobil Oil Singapore PL-Jurong	223,000	.....	² 18,000
Shell Eastern Petroleum Ltd.- Pulau Bukom	258,000	.....	² 6,800
			² 13,900
Singapore Petroleum CPL†- Pulau Merlimau	179,000	.....	² 13,500
Total	893,000	.....	63,600

†Singapore Petroleum CPL shares percentages of refinery capacities.

SOMALIA			
Iraqsoma Ref. Co.-Mogadishu	10,000	.....	.....

REFINING SURVEY

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cal reforming
SOUTH AFRICA			
Caltex Oil SA PL-Cape Town	90,000	125,000	210,500
Gencor-Durban	65,000	115,000	215,000
National Petroleum Refiners of South Africa PL-Sasolburg OFS	75,500	117,400	211,100
Shell and BP South Africa Petroleum Refineries PL-Durban	200,000	127,000	226,000
Total	430,500	34,400	62,800

SPAIN			
Asfaltos Españoles SA-Tarragona	21,000	....	....
Cia. Española de Petróleos-San Roque (Cádiz)	160,000	136,000	235,000
Tenerife	130,000	....	214,000
Ertol, SA-La Rábida, Huelva	80,000	....	214,100
Petrómed-Castellón de la Plana	120,000	123,300	218,000
Petronor SA-Somorrostro, Vizcaya	240,000	140,000	233,500
Repsol Petroleo SA-Cartagena, Murcia	120,000	....	225,000
La Coruña	135,000	128,000	222,000
Puertollano, Ciudad Real	135,000	130,000	218,000
Tarragona	180,000	....	216,000
Total	1,321,000	157,300	195,600

SRI LANKA			
Ceylon Petroleum Corp.-Sapugaskanda	50,000	....	23,750
Total	50,000	....	3,750

SUDAN			
Port Sudan Refinery Ltd.-Port Sudan	21,700	....	1,900

SWEDEN			
AB Nynas Petroleum-Gothenburg	12,500	....	....
Nynäshamn	26,000	....	....
BP Raffinaderi-Gothenburg	106,000	....	220,500
Shell Raffinaderi BV-Gothenburg	81,000	....	217,000
Skandinaviska Raffinaderi AB-Brofjorden-Lysekil	207,000	128,500	238,000
Total	434,500	28,500	75,500

SWITZERLAND			
Raffinerie de Cressier SA-Cressier	60,000	....	216,000
Raffinerie du Sud-Ouest SA-Colloby	72,000	....	210,000
Total	132,000	....	26,000

SYRIA			
Banias Refining Co.-Banias	120,000	....	220,000
Homs Refinery Co.-Homs	117,394	....	22,286
		....	9,086
Total	237,394	....	31,382

TAIWAN			
Chinese Petroleum Corp.-Kaohsiung	425,000	145,200	238,160
Tao-Yuan	117,500	....	220,340
Total	542,500	45,200	58,500

TANZANIA			
Tanzanian & Italian Petroleum Refining CL-Kigamboni, Dar es Salaam	17,000	....	22,500
Total	17,000	....	2,500

THAILAND			
Eso Standard Thailand Ltd.-Sriracha	75,000	....	28,800
Petroleum Authority of Thailand-Bangkok, Bangkok	61,750	....	29,450

WORLDWIDE REFINING	Crude capacity	b/cd Catalytic cracking	Cal reforming
Thai Oil CL-Sriracha	83,800	110,200	12,700
		215,900	26,600
Total	229,580	26,100	27,550

TRINIDAD			
Trinidad and Tobago Oil CL-Pointe-a-Pierre	166,000	126,000	222,200
Point Fortin	80,000	....	25,700
Total	246,000	26,000	27,900

TUNISIA			
Ste. Tunisienne Industries des Raffinage-Bizerte	34,000	....	3,300

TURKEY			
Anadolu Tasfiyehanesi AS-Mersin	90,000	....	212,000
Turkish Petroleum Refineries Corp.-Alaga, Izmir	226,440	114,000	29,056
Batman, Siirt	25,000	25,000	21,400
Izmit	226,440	122,644	220,285
Kirikale	135,700	....	220,342
Total	783,580	41,644	63,083

Solvent extraction: 11,700 b/cd (furfural), 6,700 b/cd (propane deasphalting).

UNITED KINGDOM			
England			
Conoco Ltd.-South Killingholme	130,000	147,000	246,000
Eastham Refinery Ltd.-Eastham, Ellesmere Port	22,000	....	....
Esso Petroleum CL-Fawley	302,400	176,500	235,300
		....	22,500
Lindsey Oil Refinery Ltd.-Killingholme, South Humberside	190,000	145,000	233,600
Mobil Oil CL-Coryton, Essex	152,000	152,000	232,000
Phillips Imperial Petroleum Ltd.-Port Clarence	100,000	....	....
Shell U.K. Ltd.-Shell Haven	92,000	....	232,000
Stanlow	262,000	159,000	229,000
		....	27,000
Total	1,250,400	279,500	257,400

Scotland			
BP Refinery Grangemouth Ltd.-Grangemouth	198,500	121,000	232,000
Briggs Oil Ltd.-Dundee	10,240	....	....
Total	208,740	21,000	32,000

Wales			
BP Refinery Llandarcy Ltd.-Llandarcy, Neath	....	....	....
Elf Oil (G.B.) Ltd.-Milford Haven	108,000	132,500	217,800
Gulf Oil-GB-Milford Haven	109,000	131,500	222,000
Pembroke Cracking Co. (65% Texaco, 35% Gulf Oil-GB)-Milford Haven	....	190,000	....
Texaco Ltd.-Pembroke, Dyfed	180,000	....	239,000
Total	397,000	154,000	78,800
Total United Kingdom	1,658,140	454,500	366,200

†Dimersol.

Company and refinery location	Crude b/cd	b/cd Catalytic cracking	Catalytic reforming
UNITED STATES			
Alabama			
Coastal Mobile Refining Co.-Mobile Bay	14,250	....	....
Gamox Energy Inc.-Theodore	26,500	25,000	....
Hunt Refining Co.-Tuscaloosa	33,500	27,500	29,800
		....	45,000
Louisiana Land & Exploration Co.-Saraland	80,000	220,000	....

REFINING SURVEY

Company and refinery location	Crude b/d	Catalytic cracking	Catalytic reforming
Total	154,250	32,500	14,800
Alaska			
ARCO Alaska Inc.—Kuparuk	12,000	.....	.....
Prudhoe Bay	17,500	.....	.....
Mapco Alaska Petroleum— North Pole	115,000	.....	.....
Petro Star Inc.—North Pole	8,000	.....	.....
Tesoro Petroleum Corp.—Kenai	72,000	¹ 12,000	.....
Total	224,500	12,000	.....
Arizona			
Intermountain Refining Co.— Fredonia	5,710	.....	.....
Sunbelt Refining Co.—Randolph	8,500	.....	.....
Total	14,210	.....	.....
Arkansas			
Berry Petroleum Co.—Stevens	¹ 5,700	.....	.....
Cross Oil & Refining Co. Inc.— Smackover	6,770	.....	.....
Lion Oil Co.—El Dorado ¹	48,000	² 9,000	.....
Total	60,470	9,000	.....
Solvent extraction: ¹ 5,500 b/d.			
California			
Anchor Refining Co. Inc.—McKittrick	10,000	.....	.....
Atlantic Richfield Co.—Carson	223,000	² 48,000	.....
Chemoil Refining Corp.—Signal Hill	14,200	.....	.....
Chevron U.S.A. Inc.—El Segundo	254,000	² 51,000	¹ 40,000
Richmond ¹	205,000	² 60,000	² 60,000
Conoco Inc.—Santa Maria	9,500	.....	.....
Edgington Oil Co. Inc.— Long Beach	41,600	.....	.....
Exxon Co.—Benicia	128,000	³ 32,000	² 37,000
Fletcher Oil & Refining Co.— Carson	29,657	⁴ 5,100	² 12,000
Golden West Refining Co.— Santa Fe Springs	44,000	² 19,000	.....
Huntway Refining Co.—Benicia	8,400	.....	.....
Wilmington	5,500	.....	.....
Kern Oil & Refining Co.— Bakersfield	20,000	² 3,000	.....
Lunday-Thagard Co.—South Gate	7,000	.....	.....
Mobil Oil Corp.—Torrance	123,000	² 36,000	³ 68,000
Pacific Refining Co.—Hercules	¹ 52,250	² 15,000	.....
Paramount Petroleum Corp.— Paramount	42,700	² 8,500	² 9,000
Powerline Oil Co.— Santa Fe Springs	46,500	² 10,000	³ 13,500
San Joaquin Refining Co.— Bakersfield	18,000	.....	.....
Shell Oil Co.—Martinez	140,100	³ 28,000	³ 50,000
Wilmington	133,300	² 24,000	³ 11,000
Sunland Refining Corp.— Bakersfield	15,000	² 1,500	.....
Ten By, Inc.—Oxnard	4,000	.....	.....
Texaco Refining & Marketing Inc.— Bakersfield	¹ 49,400	² 23,000	² 16,000
Wilmington	¹ 95,000	² 40,000	³ 30,000
Tosco Corp.—Martinez	¹ 92,000	² 20,000	² 54,000
Ultramar, Inc.—Wilmington	68,000	¹ 14,500	³ 42,000
Unocal Corp.—Los Angeles	108,000	² 52,000	.....
San Francisco (includes Santa Maria)	113,100	² 34,000	.....
Witco Chemical Corp.—Golden Bear Division—Oildale	10,348	.....	.....
Total	2,150,555	547,800	587,500
Solvent extraction: ¹ 55,000 b/d.			
Colorado			
Colorado Refining Co.— Commerce City	28,000	² 9,500	.....
Conoco Inc.—Denver	48,000	² 10,000	.....

Company and refinery location	Crude b/d	Catalytic cracking	Catalytic reforming
Landmark Petroleum Inc.—Fruita	15,200	² 3,400	.....
Total	91,200	22,900	.....
Delaware			
Star Enterprise—Delaware City	140,000	² 11,000	¹ 5,600
Total	140,000	52,000	.....
Georgia			
Amoco Oil Co.—Savannah	28,000	.....	.....
Young Refining Corp.— Douglasville	7,500	.....	.....
Total	35,500	.....	.....
Hawaii			
Chevron U.S.A. Inc.— Barber's Point	52,800	.....	.....
Hawaiian Independent Refinery Inc.—Ewa Beach	¹ 90,250	² 13,000	.....
Total	143,050	13,000	.....
†Dimersol.			
Illinois			
Clark Oil & Refining Corp.— Blue Island	66,500	² 30,500	.....
Hartford	57,000	² 12,000	.....
Indian Refining Co.—Lawrenceville	54,000	² 15,000	.....
Marathon Oil Co.—Robinson	170,000	⁴ 36,500	.....
Mobil Oil Corp.—Joliet	180,000	² 46,000	.....
Shell Oil Co.—Wood River	274,000	² 18,000	² 29,000
Uno-Ven Co.—Lemont	147,000	² 29,800	.....
Total	948,500	302,300	29,000
Indiana			
Amoco Oil Co.—Whiting	350,000	⁴ 90,000	³ 94,000
Countrymark Cooperative, Inc. Mt. Vernon	20,600	² 4,000	.....
Laketon Refining Corp.—Laketon	8,300	.....	.....
Marathon Oil Co.— Indianapolis ¹	50,000	¹ 10,500	.....
Total	428,900	104,500	94,000
Solvent extraction: ¹ 5,000.			
Kansas			
Coastal Refining and Marketing Inc.—Augusta	.....	⁴ 10,000	.....
El Dorado ¹	¹ 30,400	² 4,500	.....
Wichita	¹ 29,925	² 6,500	.....
Farmland Industries Inc.— Coffeyville	59,600	² 16,000	.....
Phillipsburg	26,400	² 5,300	.....
National Cooperative Refinery Association—McPherson	70,900	² 15,000	.....
Texaco Refining & Marketing Inc.— El Dorado	80,000	² 25,500	¹ 44,000
Total Petroleum Inc.— Arkansas City	56,000	² 18,000	.....
Total	353,225	100,800	44,000
Solvent extraction: ¹ 5,500 b/d. † Includes C ₃ -C ₆ Isom. feed.			
Kentucky			
Ashland Petroleum Co.— Cattlettsburg	213,400	² 18,000	¹ 40,000
Somerset Refinery Inc.—Somerset	5,500	² 1,000	⁴ 400
Total	218,900	48,000	40,400
†ART. ‡Reduced crude converter. †Aromatics 5,000. C ₃ /C ₄ 12,000. C ₅ /C ₆ 12,000.			
Louisiana			
American International Refinery, Inc.—Lake Charles	² 28,500	.....	.....

REFINING SURVEY

Company and refinery location	Crude b/d	Catalytic cracking b/d	Catalytic reforming b/d
Atlas Processing Co., Division of Pennzoil—Shreveport.....	46,200	² 5,000	.....
BP Oil Co.—Belle Chasse.....	² 218,500	² 37,400	.....
Calcasieu Refining Co.— Lake Charles.....	13,500	.....	.....
Calumet Lubricants Co.—Princeton.....	4,376	.....	.....
Canal Refining Co.—Church Point.....	9,865	¹ 1,900	.....
CAS Refining Inc.—Mermentau.....	15,000	.....	.....
Citgo Petroleum Corp.— Lake Charles.....	320,000	² 52,000	³ 40,000
Conoco Inc.—Lake Charles.....	159,500	² 16,000	.....
Exxon Co.—Baton Rouge ¹	421,000	⁴ 90,000	.....
Kerr-McGee Refining Corp.— Cotton Valley.....	7,800	.....	.....
Marathon Oil Co.—Garyville ²	225,000	⁵ 45,000	⁷ 71,000
Mobil Oil Corp.—Chalmette.....	160,000	² 28,000	³ 43,000
Murphy Oil USA Inc.—Meraux ²	97,000	⁶ 23,000	⁴ 15,000
Phibro Refining Inc.—Krotz Springs.....	56,700	² 12,000	.....
St. Rose.....	28,300	.....	.....
Placid Refining Co.—Port Allen ³	48,000	² 10,000	.....
Shell Oil Co.—Norco.....	215,000	² 16,000	³ 70,000
Star Enterprise—Convent.....	225,000	³ 38,000	.....
Total.....	2,296,241	499,300	277,000

Solvent extraction: ¹6,900 b/d. ²15,000 b/d. ³5,000 b/d. ⁴30,000 b/d.
⁵ Wax 1,200, Lube 5,500.
⁶ Wax 2,000, Alky feed 43,000. ⁷ Dimersol.

Michigan			
Crystal Refining Co.—Carson City.....	4,000	.....	.....
Lakeside Refining Co.—Kalamazoo.....	5,600	¹ 1,000	.....
Marathon Oil Co.—Detroit.....	70,000	² 18,500	³ 14,000
Total Petroleum Inc.—Alma.....	45,600	²14,000	⁴3,000
Total.....	125,200	33,500	17,000

Minnesota			
Ashland Petroleum Co.— St. Paul Park.....	67,100	² 23,500	³ 23,000
Koch Refining Co.—Rosemount.....	² 218,500	² 6,000	³ 63,500
Total.....	285,600	55,500	86,500

¹Dimersol.

Mississippi			
Amerada-Hess Corp.—Purvis.....	30,000	² 5,800	.....
Chevron U.S.A. Inc.—Pascagoula.....	295,000	² 90,000	³ 96,000
Total.....	325,000	95,800	192,000

Montana			
Cenex—Laurel ¹	40,400	² 12,000	⁴ 14,000
Conoco Inc.—Billings ²	49,500	² 14,700	.....
Exxon Co.—Billings.....	42,000	¹ 10,000	.....
Montana Refining Co.—Great Falls.....	7,000	² 1,000	.....
Total.....	138,900	37,700	14,000

Solvent extraction: ¹4,000 b/d. ²7,500 b/d (POA).

Nevada			
Petro Source Refining Partners— Tonopah.....	4,900	.....	.....

New Jersey			
Amerada-Hess Corp.— Port Reading.....	80,000	.....	.....
Chevron U.S.A. Inc.—Perth Amboy.....	80,000	.....	.....
Coastal Eagle Point Oil Co.— Westville.....	¹ 109,250	² 27,000	.....
Exxon Co.—Linden.....	130,000	² 28,000	³ 50,000
Mobil Oil Corp.—Paulsboro ¹	100,000	² 23,500	³ 15,000

Company and refinery location	Crude b/d	Catalytic cracking b/d	Catalytic reforming b/d
Seaview Petroleum Co. L.P.— Thorofare.....	80,000	.....	.....
Total.....	499,250	78,500	85,000
Solvent extraction: ¹ 9,500 b/d. ² Cumene.			
New Mexico			
Bloomfield Refining Co.— Bloomfield.....	16,150	² 4,000	.....
Giant Industries Inc.—Gallup.....	20,000	² 6,800	.....
Navajo Refining Co.—Artesia.....	³ 38,000	² 8,000	.....
Thriftyway Marketing Corp.— Farmington.....	2,500	² 500	.....
Total.....	76,650	19,300	.....

New York			
Cibro Petroleum Products Co.—Albany.....	39,900	.....	.....

North Dakota			
Amoco Oil Co.—Mandan.....	58,000	² 12,100	.....
Total.....	58,000	12,100	.....

Ohio			
Ashland Petroleum Co.—Canton.....	66,000	² 20,000	³ 23,000
BP Oil Co.—Lima.....	⁴ 142,500	² 55,000	.....
Toledo.....	⁴ 120,650	² 23,000	.....
Total.....	454,150	182,600	23,000

Sun Refining & Marketing Co.—
Toledo¹.....

Total.....

Solvent extraction: ¹9,000 b/d.

Oklahoma			
Barrett Refining Corp.—Thomas.....	11,000	.....	.....
Conoco Inc.—Ponca City.....	140,000	² 36,000	.....
Cyril Petrochemical Corp.—Cyril.....	12,500	.....	.....
Kerr-McGee Refining Corp.— Wynnewood ¹	43,000	⁵ 12,500	.....
Sinclair Oil Corp.—Tulsa.....	50,000	¹ 12,000	.....
Sun Refining & Marketing Co.—Tulsa ²	85,000	² 24,000	.....
Total Petroleum Inc.—Ardmore.....	68,000	⁵ 17,000	² 26,000
Total.....	409,500	101,800	26,000

Solvent extraction: ¹5,000 b/d. ²10,000 b/d.

Oregon			
Chevron U.S.A. Inc.—Portland.....	.....	.....	.....

Pennsylvania			
BP Oil Co.—Marcus Hook.....	⁴ 171,000	⁶ 50,000	² 42,000
Chevron U.S.A. Inc.—Philadelphia.....	175,000	² 34,000	.....
Pennzoil Products Co.—Rouseville.....	15,700	² 5,820	.....
Sun Refining & Marketing Co.— Marcus Hook.....	175,000	² 24,000	.....
Philadelphia.....	130,000	² 50,000	.....
United Refining Co.—Warren.....	⁶ 64,600	² 16,000	.....
Witco Chemical Co.—Bradford.....	10,000	² 1,800	.....
Total.....	741,300	181,820	42,000

Solvent extraction: ¹730 b/d

Tennessee			
Mapco Petroleum Inc.—Memphis.....	75,000	² 14,000	.....
Total.....	75,000	14,000	.....

Texas			
Amoco Oil Co.—Texas City.....	433,000	² 160,000	³ 85,000
Chevron U.S.A. Inc.—El Paso.....	66,000	² 5,000	⁴ 8,000
Port Arthur.....	315,300	² 23,000	.....
Citgo—Corpus Christi.....	132,500	⁵ 54,000	² 65,000
Coastal Refining & Marketing Inc.— Corpus Christi.....	⁴ 90,250	² 11,000	.....
Total.....	1,000,000	222,000	166,000

Crown Central Petroleum Corp.— Houston.....			
100,000	²14,000	⁴10,000	

REFINING SURVEY

Company and refinery location	Crude b/cd	h/sd Catalytic cracking	Catalytic reforming
Diamond Shamrock Corp.— Sunray ¹	111,000	² 15,000	.....
Three Rivers ²	53,000	² 25,000 ² 9,000	.....
El Paso Refining Co. Ltd.—El Paso	² 52,250	² 7,200	.....
Exxon Co. U.S.A.—Baytown ³	394,000	² 60,000 ² 63,000	² 110,000
Fina Oil & Chemical Co.— Big Spring ⁴	55,000	² 20,000	² 6,000
Port Arthur ⁵	110,000	² 34,000	² 18,000 ² 13,000
Howell Hydrocarbons Inc.— San Antonio	1,900	.....	.....
Koch Refining Co.—Corpus Christi	125,000	³ 15,000 ² 33,500	.....
LaGloria Oil & Gas Co.—Tyler	49,500	² 4,000 ² 11,700	.....
Leal Petroleum Corp.—Nixon	12,000	.....	.....
Liquid Energy Corp.—Bridgeport	10,000	.....	.....
Lyondell Petrochemical Co.— Houston ⁷	265,000	² 110,000	³ 48,000 ⁴ 46,000 ⁵ 35,000
Marathon Oil Co.—Texas City	70,000	¹ 10,500	.....
Mobil Oil Corp.—Beaumont	275,000	² 57,000 ² 46,000	.....
Phibro Refining Inc.—Houston ⁶	67,000	² 13,500	.....
Texas City	123,500	² 11,000 ² 12,000	.....
Phillips 66 Co.—Borger	105,000	² 26,000	¹ 50,000 ⁴ 40,000
Sweeny	175,000	² 36,000	¹ 75,000 ⁴ 50,000
Pride Refining Inc.—Abilene	45,500	² 6,000	.....
Shell Oil Co.—Deer Park	215,900	² 20,000 ² 43,000	² 45,000
Odessa	28,600	² 10,000	.....
Southwestern Refining Co., Inc.— Corpus Christi	104,000	² 30,000	¹ 18,000
Star Enterprise— Port Arthur	250,000	² 50,000	.....
Trifinery—Corpus Christi	18,000	.....	.....
Valero Refining Co.— Corpus Christi	27,000	² 27,000	¹ 60,000
Total	3,682,200	1,186,000	823,700
Solvent extraction: ¹ 15,000 b/sd. ² 7,000 b/sd. ³ 53,000 b/sd. ⁴ 10,000 b/sd. ⁵ 18,000 b/sd. ⁶ 17,000 b/sd. ⁷ 6,000 b/sd. ¹ Heavy oil cracker. ² Dimersol.			
Utah			
Amoco Oil Co.—Salt Lake City	40,000	² 7,600	.....
Big West Oil Co.—Salt Lake City	24,000	² 5,000	.....
Chevron U.S.A.—Salt Lake City	45,000	² 7,500	⁶ 6,000
Crysen Refining Inc.— Woods Cross	12,500	² 3,000	.....
Pennzoil Products Co.—Roosevelt	8,000	² 2,000	.....
Phillips 66 Co.—Woods Cross ¹	25,000	² 6,000	⁴ 1,600
Total	154,500	31,100	7,600
Solvent extraction: ¹ 5,000 b/sd.			
Virginia			
Amoco Oil Co.—Yorktown	53,000	⁴ 10,200	.....
Total	53,000	10,200	.....
Washington			
Atlantic Richfield Co.—Ferndale	167,000	² 56,000	⁴ 18,000
BP Oil Co.—Ferndale	² 90,250	² 16,500	.....
Chevron U.S.A. Inc.—Seattle	.....	.....	.....
Shell Oil Co.—Anacortes	89,300	² 26,000	² 7,500
Sound Refining Inc.—Tacoma	11,900	.....	.....
Texaco Refining & Marketing Inc.— Anacortes ¹	132,000	² 30,000	.....
U.S. Oil & Refining Co.—Tacoma	32,775	² 6,000	.....
Total	523,225	134,500	25,500
Solvent extraction: ¹ 4,500 b/sd.			
West Virginia			
Phoenix Refining Co.— St. Mary's ¹	19,180	¹ 1,500	.....

Company and refinery location	Crude b/cd	h/sd Catalytic cracking	Catalytic reforming
Quaker State Oil Refining Corp.— Newell	10,500	² 3,400	.....
Total	29,680	4,900	.....
Solvent extraction: ¹ 1,000 b/sd.			
Wisconsin			
Murphy Oil USA Inc.—Superior	32,000	² 8,000	⁴ 5,800
Wyoming			
Frontier Oil & Refining Co.— Cheyenne	35,000	² 6,600	.....
Little America Refining Co.— Casper	22,000	² 6,000	.....
Sinclair Oil Corp.—Sinclair	54,000	² 14,500	² 21,000
Wyoming Refining Co.—Newcastle	11,900	¹ 2,750	.....
Total	122,900	29,850	21,000
WORLDWIDE REFINING			
	Crude capacity	h/sd Catalytic cracking	Cal reforming
URUGUAY			
Ancap-La Teja, Montevideo	28,500	¹ 4,750	² 8,850
Total Uruguay	28,500	4,750	8,850
U.S.S.R.			
Government-owned refineries at Achinsk, Angarsk, Baku, Batumi, Chimkent, Drogobych, Fergana, Gorki, Grozny, Guryev, Ishimbai, Khabarovsk, Kherson, Kirishi, Komsomolsk, Krasnovolsk, Kremenchug, Kuibyshev, Laischansk, Mazheikiai, Moscow, Mozyr, Nadvornaya, Nizhnekamsk, Odessa, Omsk, Orsk, Pavlodar, Perm, Polotsk, Ryazan, Saratov, Syzran, Teapsee, Ufa, Ukhta, Vannovskiy, Volgograd, and Yaroslavl.			
Total	12,300,000		
VENEZUELA			
Corpoven—El Palito, Carabobo	105,000	¹ 50,400	² 8,900
El Torero, Llanos	4,800	.....	.....
Puerto La Cruz, Anzoategui	199,000	¹ 13,600	.....
San Roque, Anzoategui	5,200	.....	.....
Lagoven—Judibana, Falcon	571,000	¹ 97,200	.....
Maraven—Punta Carón, Falcon	286,000	¹ 59,500	.....
Total	1,171,000	226,700	8,900
VIRGIN ISLANDS			
Hess Oil Virgin Islands Corp.— St. Croix	545,000	.....	² 125,000
Total	545,000	.....	125,000
YEMEN			
Aden Refinery Co.—Little Aden ¹	104,500	.....	² 7,600
Yemen Hunt Oil Co.—Marib	10,000	.....	² 2,500
Total	114,500	.....	10,100
Solvent extraction: ¹ 7,920 b/cd.			
YUGOSLAVIA			
Bosanski Brod ¹	112,835	.....	² 7,612 ³ 13,500
Lendava	14,600	.....	.....
Novi Sad	63,000	.....	² 8,200
Pancevo	108,000	² 20,750	² 8,800
Rijeka	180,000	² 21,300	² 17,900
Sisak	150,000	² 10,000	² 19,000
Zagreb	700	.....	.....
Total	699,135	52,050	74,612
Solvent extraction: ¹ 3,300 b/cd (dismantling).			
ZAIRE			
Solbi—Muanda	17,000	.....	² 3,000
ZAMBIA			
Indeni Petroleum Refinery CL— Bwana Mubwa Area, Ndola	23,788	.....	² 8,339